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United States
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Circuit Court of Appeals
For the Ninth Circuit.

Transcript of Record.

(IN THREE VOLUMES.)

WILSON & WILLARD MANUFACTURING
COMPANY, a Corporation,

Appellant,

vs.

UNION TOOL COMPANY, a Corporation, ED-
WARD DOUBLE, ROSA EICHENHOFER,
as Administratrix of the Estate of FRIED-
RICH EICHENHOFER, Deceased, and
GEORGE L. CHADDERDON,

Appellees.

VOLUME II.

(Pages 321 to 736, Inclusive.)

Upon Appeal from the United States District Court
for the Southern District of California,
Southern Division.

Filed

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(Testimony of Edward North.)

Redirect Examination.

(By Mr. BLAKESLEE.)

Q. 143. What, if anything, was said during the period including the negotiations which culminated in 1904 contracts with respect to competing with underreamers then in the field?

A. I can't remember exactly. I know Mr. Double encouraged me that we would be able to compete, in fact, the contract there specifies on his part that he will push the sale not only in California but in the eastern states and other parts of the United [269] States.

Q. 144. As to this \$50 royalty on the North reamer which was to be paid by the Union Oil Tool Company, please state again how that was to be apportioned as to yourself and Mr. Double?

A. The contract speaks for itself. It was half and half. He was to have half and I half.

Q. 145. When was it you tried to get Mr. Double's interest in the North patent back from him?

Mr. LYON.—Objected to as irrelevant and immaterial.

A. I tried to get him to name a figure on it in 1905 or '6, I have forgotten now which.

Q. 146. (By Mr. BLAKESLEE.) What did Mr. Double tell you when you made this attempt to get it back?

Mr. LYON.—Objected to unless the time and place of the alleged conversation is more definitely fixed.

A. He said he did not care to sell.

(Testimony of Edward North.)

Q. 147. (By Mr. BLAKESLEE.) Anything further? A. I don't remember that there was.

Q. 148. Are you able to locate the time of this conversation more definitely? A. No.

Q. 149. And as to the place, where was it?

A. Here in Los Angeles.

Q. 150. Can you state any more definitely than that? A. It was a telephone conversation.

Q. 151. Do you remember where you were?

A. I think I was in the H. W. Hellman building. By the way, that enables me to fasten it a little. It was in 1906.

Q. 152. Are you able now to state any more definitely what time of the year? A. No.

Q. 153. Did you make any proposition to Mr. Double in that telephone conversation as to what you would do in this connection? [270]

Mr. LYON.—Objected to as being incompetent, calling for the conclusion of the witness, not for a statement of the conversation, and therefore incompetent.

A. No.

Q. 154. (By Mr. BLAKESLEE.) Have you anything further to say with relation to the Jones 1906 patent, any invention disclosed therein, as to its relation with the arrangement and agreements you entered into with Mr. Double and his company?

A. The agreement between Mr. Double and myself for him to manufacture the—or the Union Tool Oil Company—to manufacture reamers was made without any reference to the Jones reamer whatsoever.

**Testimony of W. W. Wilson, for Defendant
(Recalled).**

A. 344. This O'Donnell & Willard patent covers an underreamer consisting of a solid body having means of attachment to suitable tools at the top, and having a tapering hole bored centrally in the lower end of the body for a distance, above which there is a straight hole for the reception of a spring and T-rod. In the upper end of the tapered hole there is a threaded portion into which a wedge-shaped piece shown at 3 in the drawing, which wedge-shaped piece is provided at its top with a threaded portion and may be made to engage with the threaded portions of the body. The wedge-shaped portion 3 has drilled through its upper portion a hole 6 for the passage of the mandrel rod, and below this hole is a slot 4 to allow movement of the laterally-extending lugs of the lower end of the T-rod, said slot being long enough to allow sufficient play to the T-rod to give proper action to the cutters. On the lugs of the T-rod, fastened thereto by slots threading over these lugs, are two cutters, 12 and 12'. These cutters have shanks which are arranged to fill the cavity on each side of the wedge, portion 4, when the cutters are in expanded position. Below these [271] shanks of the cutters are bodies terminating at their lower ends in outwardly projecting cutting faces. The upper portion of the mandrel rod has around it a spring, which spring bears on its lower end on the threaded plug, on the upward end of the partition 4, and the spring at its upper end bearing against threaded

(Testimony of W. W. Wilson.)

nuts which are screwed on the threaded portions of the top end of the mandrel rod. This spring being in compression, tends to draw the cutters to expanded position. The collapsing of the cutters is caused by their sliding downward over the wedge-shaped piece 3 which allows the lower ends of the cutters to come together. Also, the upper ends of the cutters ride outwardly, bearing against the outer walls of the tapered pockets, allowing them to tilt outwardly, causing the further contraction of the cutters, due to the tilting over the fulcrum, over the lower end of the wedge-partition 3. To maintain the wedge-shaped portion 3 in position when the tool is being used, there are plugs 28 which pass through holes in the side of the body and are threaded into the wedge-shaped portion 3, preventing it from unscrewing out of the body. The reamer is also provided with a locking device for locking the cutters into reaming position when below the casing. This locking device consists of a plug 21 which slides sideways in the hole in the wedge-shaped portion 3 and extends outward through the body through suitable holes. This plug has behind it another plug which has a tapered face 17, which may pass underneath the lower end of the T-rod. Behind this plug 16 there is a spring which bears against it, at one end, and on the other end bears against a threaded button 19, to hold it in place. When the reamer is run in the casing the plug 21 is pressed inwardly, causing plug 16 to be thrown back in such position that the beveled face of 23 on the mandrel rod engages the bevel face

(Testimony of W. W. Wilson.)

17 on the inner plug 16, so that the mandrel rod may be drawn down by means of the cutters, forcing the plug 16 back, compressing the spring 20, allowing the [272] cutters to be withdrawn and collapsed. When the reamer is run in the hole the sides of the bodies of the cutters bearing against the casing hold them in collapsed position until the cutter passes the shoe, when this pressure is released, allowing the spring to draw the cutters up into the working position. This movement of the mandrel rod upward, frees plug 16, allowing it to press against the plug 21. When the reamer is further lowered allowing the plug 21 to move past the shoe, it is forced outward against the shoulder 25 allowing the plug 16 to move still further in, so that there is a plane surface bearing against the bottom of the mandrel rod holding it in that position. Thus the cutters are locked and cannot be withdrawn or displaced when beyond the casing. When the reamer is withdrawn from the casing the plug 21 first strike the shoe, causing it to move inwardly, which causes the plug 16 to move to such position that the shoulder 17 may be engaged by the mandrel rod. On further withdrawing the reamer from the casing the casing shoe strikes the shoulders on the cutters causing them to be drawn downward, the tapered shoulder 23 on the lower end of the mandrel rod striking the beveled face 17 on the plug 16 and causes it to be thrown further over against the compression of the spring, allowing the cutters to be drawn downward into col-

(Testimony of W. W. Wilson.)

lapsed position when the reamer may be withdrawn from the casing.

Q. 347. Will you please compare this model with the "Defendant's Exhibit O'Donnell and Willard Patent"?

A. The model is a disclosure of the O'Donnell and Willard patent with the exception that the pins 28 for retaining the wedge-shaped partition in place are not shown in the brass model. Also, the locking means consisting of plug 19, spring 20, plug 16 and plug 21, shown in the patent drawing, are not present in the brass model.

Q. 348. Please state where you got this brass model.

A. This model was made at the Wilson & Willard Manufacturing Company in compliance with the disclosure of the patent about the [273] time that I was first employed at the Wilson & Willard Manufacturing Company.

Q. 349. Please state what you know personally as to its manufacture.

A. I handled the orders on the books at the time it was made at the Wilson & Willard Manufacturing Company and saw it in construction at that time.

Mr. BLAKESLEE.—The small brass model just discussed is offered in evidence as "Defendant's Exhibit Partial O'Donnell and Willard Underreamer on Diminutive Scale."

Mr. LYON.—Objected to as incompetent and as fragmentary and as not embodying either the construction or mode of operation of the disclosure of

(Testimony of W. W. Wilson.)

the O'Donnell and Willard patent, and as misleading.

Q. 350. (By Mr. BLAKESLEE.) Have you examined "Defendant's Exhibit O'Donnell and Willard Underreamer?" A. I have.

Q. 351. Please compare the same with the disclosure of "Defendant's Exhibit O'Donnell and Willard Patent."

A. The "Defendant's Exhibit O'Donnell and Willard Underreamer" differs from the disclosure of the O'Donnell and Willard Underreamer patent in that there are no locking means as shown by plug 19, spring 20, plugs 16 and 25, present in the O'Donnell and Willard underreamer. The O'Donnell and Willard underreamer exhibited also differs from the patent in that there is placed on the upper portion of the body a ring, which ring has in its upper portion a key which passes through a slot in the body over the top of the T-rod and at 90 degrees around the circumference of this ring there are casing engaging means which extend outward to a greater diameter than the inside of the casing when the reamer is in expanded position. In the body underneath these casing engaging means are suitable slots so arranged that when the engaging means are drawn downward sufficient [274] to compress the spring they may move inward to a contracted position in the reamer body, their outside diameter then being equal to or less than the inside of the casing. This device is used for the purpose of holding the spring in compressed position, and, therefore, reduces its upward pressure on the cutters when the reamer is

(Testimony of W. W. Wilson.)

being run into or out of the casing.

Q. 356. (By Mr. BLAKESLEE.) Please compare the operation of the reamer disclosed in "Complainants' Exhibit Double Patent" with the operation of the reamer disclosed in "Defendant's Exhibit O'Donnell and Willard Patent," eliminating from consideration the features of "Defendant's Exhibit O'Donnell and Willard Patent" which are lacking in "Defendant's Exhibit O'Donnell and Willard Reamer," upon encountering sticky formations or other unusual formations, such as you have referred to.

A. In each reamer there is a body with means for attachment to the tools at the upper end, each having a central bore for the placement of spring and mandrel rod, such spring on the upper end bearing against the end threaded on the upper end of the mandrel rod, and on its lower end in the Double underreamer disclosed against a shoulder in the underreamer body, and in the O'Donnell and Willard underreamer against a shoulder on the upper end of the threaded plug on the top of the central partition. The mandrel rod in the Double underreamer at its lower end has a slot for the reception of a key, which key extends downward through a slot in the body into contact with the upper edges of the slots in the shanks of the cutters. In the O'Donnell and Willard patent the lower end of the mandrel rod is integral, forming a T-rod, with lugs extending outward in contact with the upper edges of the slots in the cutters. The cutters in both cases are separated

(Testimony of W. W. Wilson.)

completely to an expanded position by a partition between them, which partition has a hole for the passage of the mandrel rod and a slot for the movement and directing of the key on the Double underreamer, and the lugs on the lower end of the T-rod in the O'Donnell and Willard underreamer. This partition remains partly between the cutters when in contracted position in both the Double underreamer and [275] in the O'Donnell and Willard underreamer. The contraction of the cutters is caused in both cases by the movement downward over the end partition, allowing the removal of the partition to allow the cutters to collapse together at their lower ends, and also by the movement outward of the shanks of the cutters in the O'Donnell and Willard underreamer bearing against the downwardly outwardly tapering faces of the pockets in which the cutters move, and in the Double underreamer caused by the upper ends of the dovetail of the cutters riding outwardly on the outwardly downwardly tapering of the dovetail shoulders on the body. The tilting of the cutters in both cases being complex, the movement of the slots in the shanks of the cutters being partly tilting and partly sliding in their movement to contracted or expanded position in both reamers. The outwardly downwardly tapering faces on the cutter pockets in the O'Donnell and Willard underreamer, and also the outwardly downwardly tapering dovetail shoulders in the Double underreamer, are placed as they are to allow the spreading of the upper ends of the cutter shanks, which causes

(Testimony of W. W. Wilson.)

collapsing of the cutting points because of riding over a sliding fulcrum near the center of the cutter lengths. The operation of the reamers in running in a hole, expanding and withdrawing, is the same in both reamers.

With the collar of the O'Donnell & Willard underreamer omitted, the action of the cutters when running down the casing or when striking against the casing shoe at the bottom when collapsing and drawing down over the spreading bearing is the same. The action of the cutters when in operation would be the same in most cases, and the cutters would tend to stick in the hole, and the cutters would probably stick due to the suction until the upward removal of the wall or partition from the cutters which would allow the cutters to collapse until they would be released from the suction.

The Wilson underreamer as disclosed by the Wilson underreamer [276] patent consists of a body having a hole drilled from the bottom for the reception of a spring and key-rod. A block acting as a seat for the spring, the spring being confined on the key-rod by a nut, the block being held in place, detachably, by means of screws or dowel pins. The underreamer is equipped with two cutters which are spring actuated, and are mounted between two prongs which constitute the lower end of the reamer body. These prongs have on their inner faces ridges 3 and on the lower end of the prongs are spreading faces 9 and 17. The cutters have ridges or dovetail shoulders on their sides 4² which engage the ridge 3

(Testimony of W. W. Wilson.)

on the inner faces of the prongs. The cutters have pockets for the reception of lugs on the T-rod on which lugs the cutters are suspended. The collapsing of the cutters is caused by their downward movement against the pull of the spring and the T-rod. This downward movement allows the cutters to pass down, over and beyond the faces 9 on the prongs, and to slide inward with the upper edges of the faces 4³ bearing against the spreading faces of 17. The expansion of the cutters is produced by the pressure of the spring which draws in the cutters upwardly and over the spreading bearings on the ends of the prongs of the reamer body.

Testimony of William Plotts, for Defendant.

Mr. Plotts testifies as follows:

My name is William Plotts; my former occupation was well driller. I am retired now. Age, 56. Resident of Whittier. I commenced in the oil business about 38 years ago. My first experience was in Pennsylvania. Have operated in the different fields of California. Last experience was in Whittier. I am familiar with underreamers among which was the Snow underreamer and the next was the Austrian. The first Austrian I used was in Santa Paula in 1897. The Austrian was unsatisfactory on account [277] OF BEING WEAK IN THE PIVOT. It was so unsatisfactory that I decided to improve it. I designed an underreamer myself covered by underreamer patent No. 668,340, issued February 19th, 1901. Have used the Plotts under-

(Testimony of William Plotts.)

reamer ever since up to some three years ago when I quit active work in the oil business. I was connected with the Murphy Oil Company and we usually run about four sets of tools. Have reamed about 35 wells with the Plotts underreamer, possibly 40. It gave us good results. Better results than we have got from any other kind. My company, in which I was interested, after I quit active work, got some underreamers known as the "Double" underreamers; but they did not find them satisfactory. They used Double underreamers and Plotts underreamers at the same time they made this test of the Double reamer. I believe it is generally conceded the Double reamer is faster, if there is no tendency to get a crooked hole.

Q. 114. You say that the Murphey Oil Company drillers found it necessary to go back to the Plotts reamers. Have you personal knowledge of this matter? A. No. It is only my information.

Mr. LYON.—We move to strike from the record and exclude from consideration all that testimony of the witness which deals with the matter last inquired about, as hearsay; not the best evidence.

A. My information is also more than just merely being informed, because they are now using the Plotts underreamer, when they discarded it temporarily for the Double some three years ago.

The Plotts underreamer has been used in various oil fields in California, and they were also shipped to the West Virginia fields.

The Plotts underreamers were made by B. D.

(Testimony of William Plotts.)

Tillinghast, of McDonald, Pennsylvania. The Plotts underreamers were changed slightly from that disclosed in the patent, by placing the spring above the cutter and back of the pivot. That is about the only difference. [278]

Cross-examination.

I came to California in 1897 and went to Santa Paula that year. I drilled for the Union Oil Company at Santa Paula.

The weakness of the Austrian underreamer was the pivot pin, or the pin to which the cutters were attached, which would bend and prevent the cutters from expanding. The Austrian underreamer was not satisfactory on that account.

I made a contract with Mr. Tillinghast in 1897 and he has continued the manufacture of the Plotts underreamer from that time until the present time. He made them on a royalty basis. I was superintendent of the Murphey Oil Company for 11 years. I am vice-president of that company to-day. In speaking of breaking of cutters in Plotts reamers there were certainly not more than a half dozen broken in all the course of the use of that tool on the Murphey property. They are now using Plotts underreamers after having found the Double unsatisfactory. The Plotts is so designed that we run a standard-drilling bit below it. The Plotts underreamer is used with the drilling bit at the end of the string of tools, the drilling bit is under the reamer. It could be used without carrying the main drilling bit at the end but it would not be so satisfactory

(Testimony of William Plotts.)

ordinarily, the bit steadies it up in the hole and causes it to make the hole straight, preventing it from flopping around sideways. I have lost strings of tools in the hole mainly due to broken pins. Any tools that diminishes breakage or the occurrences of breakage in drilling wells is an advantage.

Testimony of Albert Schinneller, for Defendant.

Testifies as follows: My name is Albert Schinneller, residence, Whittier; occupation, Driller and Superintendent of the Murphey Oil Company. I have been with the Murphey Oil Company thirteen years. I am acquainted [279] with Mr. William Plotts. I have been tool dresser, driller and a little of everything during the time I have been with the Murphey Oil Company, but I am now superintendent. Before that time I was a driller in Pennsylvania. I am acquainted with the use of underreamers. The first reamer I used was the Plotts reamer. That was in the Whittier fields, that reamer was designed by Mr. Plotts. To run the reamer into the hole the cutters are doubled down, and it opens up when it comes out at the lower end of the casing. You then hitch on to the line and drill or ream with it the same as when drilling with standard tools.

We have also used Double underreamers on the Murphy Oil property. 4,700 feet is the deepest well we are drilling on it now, using the Plotts reamer. We encountered shells all the way from a few inches to I guess a hundred feet in thickness. We have reamed hard places for a hundred feet thick.

(Testimony of Albert Schinneller.)

Q. 18. I now show you "Defendant's Exhibit Plotts Patent No. 668,340," and ask you to examine the drawing of the same and tell us if what you see there relates in any manner to the Plotts underreamer to which you have referred.

Mr. LYON.—Objected to as leading, and as incompetent, the witness not having qualified to answer the question; and upon the further ground that it is apparent that it is intended to educate the witness for his further testimony in this case, and highly improper proceeding; and on the further ground that it is incompetent and not the best evidence and no foundation laid for the introduction of secondary evidence.

A. No.

Mr. BLAKESLEE.—Well, if counsel does not like this method of procedure, we will get at it in another way.

Q. 19. Please give us a statement of the general construction and organization of the parts of this Plotts reamer to which you have referred. [280]

A. That is the body of it, and the cutter, mandrel, spring and the sub.

About four years ago we started to use Double reamers. They are still using the Double reamer and the Plotts reamer too. We have never quit using the Plotts underreamer as we are still using it. Up to four years ago we used none but the Plotts reamer; at that time we got one Double reamer. I think we have had six Double reamers altogether. We run three wells, used three Plotts reamers and

(Testimony of Albert Schinneller.)

one Double reamer. Generally run about four strings of tools. We had good success with the Double all but one hole, which hole went crooked and broke the cutters off. We then changed from the Double reamer to the Plotts reamer and carried the hole about 200 feet.

The Double underreamer was broke right through the eye that holds the cutters. Lost the lower part of the cutters in the hole. We had to drill up the broken Double cutters in the hole. I like the Plotts reamer, especially on small holes, for the reason that the Plotts reamer is a little stronger, not so liable to lose the cutters, or break the cutters off. Furthermore, if the cutters should be broken off it is smaller and there is less trouble to drill them up. Never had any trouble to get the Plotts underreamer out of the hole. I have had some trouble in doing so with the Double. We broke the body of a $5\frac{5}{8}$ inch Double underreamer. The use of a drilling bit in connection with the Plotts underreamer is merely to be used as a guide. After breaking the bit off of the Double underreamer in the crooked hole, we again attempted to run the Double reamer with the new style cutters or bits, we broke a cutter and it broke the reamer too. It broke out the side of the reamer and we could not run it any longer. The reamer was practically a new one.

The hole in which we broke the Double underreamer was the first hole crooked enough to give us any trouble. [281]

The Plotts underreamer cutters up to $9\frac{5}{8}$ are 3

(Testimony of Albert Schinneller.)

inches wide. The $4\frac{1}{2}$ inch has cutters $1\frac{1}{2}$ inches wide. I ordered the first Double underreamer at $6\frac{5}{8}$ inch because we were running casing at that time with very thin shoes on. I think you can ream faster if you have a good hole when running the Double reamer, than you can with the Plotts. The reason for this increased speed with the Double reamer is because they have wider cutters. If they did not have wide cutters I think there would not be much difference between the speed of the Double and the Plotts. In bad holes I believe I prefer the Plotts reamer to the Double.

Have broken the cutters off the Plotts reamer. That was due to large shells; hit too hard; rough usage, may be. We frequently break drilling apparatus of all kinds. We use a "sub" with the Plotts reamer. Never had any trouble with any of the joints unscrewing. More or less every hole in those sliding shells in those hills is crooked. (Shown the cuts of the Austrian reamer in the Oil Well Supply Company's catalogue in evidence, witness identifies this as the Plotts reamer, saying: "They look practically the same to me. There may be a little difference in them.)

My reason for ordering the first Double reamer was we were running some light casing with very thin shoes. We had punched several of the other shoes reaming with the Plotts reamer. If you have a good hole you can ream faster with the Double reamer than with the Plotts. I think it takes about a third of the time to ream with the Double in a good

(Testimony of Albert Schinneller.)

hole that it does with the Plotts; it depends some on the formation. Since we bought the Double reamers we have not used the Plotts reamers with the thin shoes. In regard to thin shoes,—well, we want to keep the hole as large as we can, and therefore we want to get as heavy a pipe or as large a pipe down the hole; say like, for instance, $7\frac{5}{8}$ hole we are drilling, and we want to keep the hole large so we could use $6\frac{5}{8}$ pipe inside of that; that would require a thin shoe on that to go through the $7\frac{5}{8}$ and thin collars on that. In oil well [282] drilling it requires the use of thin shoes and thin collars. The Murphy is the only company I know of ever using the thin shoes and collars. I have had no experience in California outside of the Murphy property. When we broke the Double reamer the hole was crooked and the Double reamer goes to straighten the hole, and it was practically solid, solid formation there, what broke it practically drilling a new hole, might say; starting to drill a hole. [283]

**Direct Testimony of W. W. Wilson, for Defendant
(Resumed).**

(By Mr. BLAKESLEE.)

Q. 360. Please compare the disclosure of “Defendant’s Exhibit Wilson Patent” with the construction and Inter-relations of parts embodied in each of “Complainants’ Exhibits Double Underreamer and Wilson Underreamer” and “Defendant’s Exhibit Double Underreamer,” and “Complainants’ Exhibit Wilson Underreamer Number 2.”

A. The Wilson underreamer as disclosed in the

(Testimony of W. W. Wilson.)

Wilson patent is the same as the underreamer shown in "Complainants' Exhibit Wilson Underreamer" and "Complainants' Exhibit Wilson Underreamer Number 2," excepting as follows: The means of holding the lower end of the spring consisting of blocks 7 and pins 8 are changed in the "Complainants' Exhibit Wilson Underreamer," the blocks being extended down a little further between the cutters, and instead of having the pins 8 passed partly through the sides of the block and being parallel one on each side of the block, the two pins are short and are screwed into the sides of the body with pin-like extensions on their end, which fit into holes in the block. The construction is mechanically equivalent, the change being made to effect easier removal and placement of the block. In "Complainants' Exhibit Wilson Underreamer Number 2," the block 7, shown in the patent, is now used, the spreading feature on the lower end of the block being replaced by having an enlargement on the lower end of the T-rod with faces on the sides on which prongs are which bear against the cutter shanks when the reamer is in expanded position. The spring, instead of resting on the block 7, as shown in the patent, bears upon a key which is placed through slots in the side of the body above the shoulders corresponding [284] to the shoulders 10 in the patent, and in order to place the key centrally a slot is cut through the T-rod for this purpose. In the underreamers shown in the patent the means of limiting the downward movement of the cutters was the safety-bolt 11. In the "Com-

(Testimony of W. W. Wilson.)

plainants' Exhibit Wilson Underreamer" a pipe is used on the T-rod for this purpose. In "Complainants' Exhibit Wilson Underreamer Number 2" the slot in the T-rod in which the stationary key is placed, is arranged so that the top of the slot strikes the key at the downward limit of the movement of the cutters. Comparing, now, the Wilson underreamer patent and the "Defendant's Exhibit Double Underreamer," taking first the cutter, the pocket 18, in the cutter shank in the Wilson underreamer patent, is replaced in the Double cutter by a slot cut clear through the shank of the cutter, which slot is longer and narrower proportionate to the cutter than the slot 18 in the patent. Also there is a hole passing through the shank of the cutter and through the bottom of the opening of the slot in the cutter for replacement of key retaining pin, which does not exist in the Wilson cutter. The cutter shown in "Defendant's Exhibit Double Underreamer" has a pocket cut in the back of the cutter, which pocket is for the purpose of allowing the cutter to collapse over the partition of the Double underreamer body or extension, which has no counterpart in the Wilson cutter shown in the patent drawing. Below this pocket on the Double cutter is a single bearing face, which face is placed on the shank of the cutter or the part thereof extending upwards from the body or main portion of the cutter, which face bears against the spreading partition of the body extension. In the Wilson cutter no such bearing face exists on the shank of the cutter. The bearing face in that cutter being the

(Testimony of W. W. Wilson.)

face 43, which face is on the back of the cutter body and which face tapers outwardly and upwardly with respect to the [285] center line of the cutter. In Double underreamer, shown in "Defendant's Exhibit Double Underreamer," the cutter spreading face mentioned is a parallel to the axis of the cutter. On the sides of the Cutter shown in "Defendant's Exhibit Double Underreamer," are retaining ways extending the full length of the cutter shank similar to the retaining ways 4.2 shown in the Wilson underreamer patent. At the lower end of the shank of the Double underreamer cutter are extra dovetail shoulders extending the length of the spreading bearings, which have no counterpart in the Wilson underreamer cutter. The form of the body shown in Defendant's Exhibit Double Underreamer" differs from that of the Wilson underreamer patent in that there are pockets cut on the sides of the body for the reception of wrench, which do not exist on the sides of the body of the Wilson underreamer. In Double underreamer shown there is a hole throughout the length of the lower body portion, which hole has a shoulder for the seating of the spring, which does not exist in the Wilson patent. The hole in this body, "Defendant's Exhibit Double Underreamer," extends on down throughout the length of the extension, while in the Wilson patent the hole for the mandrel rod and spring is carried only down to the shoulders 10. Below this point in the Wilson underreamer patent there is a large open space formed by the prong-like extensions of the body. This open

(Testimony of W. W. Wilson.)

space does not exist in the "Defendant's Double Underreamer" shown. In the "Defendant's Exhibit Double Underreamer" there is a central partition in the extension through which partition the hole for the mandrel rod is drilled, and in the sides of this partition are slots for the passage and movement of the key placed on the lower end of the mandrel rod. These slots, in "Defendant's Exhibit Double Underreamer" are long, narrow openings in the metal for the passage of the key. No such slots exist in the Wilson underreamer patent. At the sides of the partition of the Double underreamer [286] shown there are undercuts in the sides of the cutter pockets forming dovetails to act with those on the cutters. In the Wilson underreamer there are ridges on the insides of the prongs, said ridges shown at 2", which coact with the dovetails on the shanks of the cutters. In Double underreamer body shown in "Defendant's Exhibit Double Underreamer," there is a second dovetail groove at the lower end, which does not exist in the Wilson Underreamer patent. These differences named in the comparison with Wilson underreamer patent and "Defendant's Exhibit Double Underreamer" also exist between the Wilson underreamer patent and "Complainants' Exhibit Double Underreamer" with the exception that the lower extra dovetail shoulders on the cutters are not present in "Complainants' Exhibit Double Underreamer"; also the extra dovetail undercuts in the lower end of the body extension, which coact with these extra dovetail shoulders on

(Testimony of W. W. Wilson.)

the cutters, are also absent from "Complainants' Exhibit Double Underreamer." Also in "Complainants' Exhibit Double Underreamer" the shoulder at the top of the cutter shank, instead of being at right angles to the back of the cutters, is tapered downwardly and outwardly. Also the shoulders of the body against which these bearings engage are also tapered downwardly and outwardly. These shoulders in the Wilson underreamer patent being also at right angles to the backs of the cutters. The cutters shown in "Complainants' Exhibit Double Underreamer" have the bearing face on the back, move downwardly from its position on the shank of the cutter, as shown in "Defendant's Exhibit Double Underreamer" to a position partly upon the shank of the cutter and partly upon the upper inner edge of the body of the cutter. The cutters, "Complainants' Exhibit Double Underreamer," have decided extensions sideways of the body part of the cutter from the shank of the cutter, which do not exist in "Defendant's Exhibit Double Underreamer" [287] except to a small degree, but which are shown in the Wilson Underreamer Patent, figures 7 and 9, at 16. The tops of these shoulders of the cutters in "Complainants' Exhibit Double Underreamer" are tapered downwardly and outwardly instead of being perpendicular to the back of the cutter, as shown in Wilson underreamer patent. The body of "Complainants' Exhibit Double Underreamer" differs from "Defendant's Exhibit Double Underreamer" in that the sides of the lowest end of the partition

(Testimony of W. W. Wilson.)

V-shaped notches cut at the bottom of the body dovetails, which notches allow room for the sideways extension of the cutter bodies, when the cutters are in expanded position. This space, or shoulders, on the lower ends of these parts on the extension, are shown in the Wilson underreamer patent at 10; however they are at right angles to the axis of the body instead of being downwardly and outwardly tapered. The dovetail shoulders shown in "Defendant's Exhibit Double Underreamer" and "Complainants' Exhibit Double Underreamer" taper downwardly and outwardly, while those shown in "Complainants' Exhibit Wilson Underreamer" and "Complainants' Exhibit Wilson Underreamer Number 2" and in the patent, are parallel to each other and to the axis of the reamer body. The upper shoulders on the bodies of the cutters shown at 16 of the patent are shown to contact with the shoulders 10' on the underreamer body; however, the "Complainants' Exhibit Wilson Underreamer" and "Complainants' Exhibit Number 2 Wilson Underreamer," these do not contact but a space is left between them when the cutters are in expanded position. In "Complainants' Exhibit Double Underreamer" there is a space left between these shoulders; they do not contact when in expanded position. The T-bars shown in "Complainants' Exhibit Wilson Underreamer" and "Complainants' Exhibit Wilson Underreamer Number 2," consist of a rod on the solid lugs 5 on the bottom thereof similar to the drawing figure [288] 11, such shoulders being for engagement with the cutters.

(Testimony of W. W. Wilson.)

The mandrel rods for "Complainants' Exhibit Double Underreamer" have a removable key at this point.

Q. 361. Have you anything further to state in comparison of the construction of the cutters shown in "Defendant's Exhibit Wilson Patent" and the cutters shown in "Complainants' Exhibit Double Underreamer?"

A. The cutters shown in "Complainants' Exhibit Double Underreamer" differ from those of "Defendant's Exhibit Double Underreamer," aside from the previous remarks, in the length of the shank of the cutters, that of the "Complainants' Exhibit Double Underreamer" being shorter than that of "Defendant's Exhibit Double Underreamer." Also the length of the body of the cutter "Complainants' Exhibit Double Underreamer" is considerably longer than the length of the body of the cutter "Defendant's Exhibit Double Underreamer." Also the width of the body of the cutter "Complainants' Exhibit Double Underreamer" is wider than that of the "Defendant's Exhibit Double Underreamer."

Mr. BLAKESLEE.—Direct examination closed.

Mr. LYON.—Cross-examination is reserved until the witness has produced the drawings requested.

STIPULATION.

It is further stipulated and agreed that the R. H. Herron Company and Oil Well Supply Company, in 1899 had places of business and stores at Los Angeles, Los Angeles County, California; San Francisco, California; Coalinga, California; and Bakers-

field, California; and that such places of business or stores were continued from and during 1899 continuously to date.

It is further stipulated and agreed that the page 82 of the Oil Well Supply Catalogue of 1900, and Figures 1713, 1715, 1717, and printed matter accompanying same, heretofore exhibited to [289] different witnesses in this case, is offered in evidence and marked, "Defendant's Exhibit Page 82 Oil Well Supply Company's Catalog of 1900"; and it is stipulated that this exhibit was published by the said Oil Well Supply Company in 1900 and generally circulated in 1900 and 1901 throughout the oil-well trade in California and elsewhere.

And it is further similarly stipulated that Fig. 2161 of the Oil Well Supply Company's Catalog of 1900, appearing on page 117 of said catalogue, and heretofore referred to by some of the witnesses, is offered in evidence as "Defendant's Exhibit Fig. 2161 Oil Well Supply Company's Catalog of 1900," and that such catalog was published, with said figure in 1900, and distributed throughout the oil fields of California and elsewhere during 1900 and 1901. The stipulation in regard to "Defendant's Exhibit page 82 of Oil Well Supply Company's Catalog of 1900" and this "Defendant's Exhibit Fig. 2161 of the Oil Well Supply Company's Catalog of 1900," is not to be understood, however, as stipulating that these 1900 catalogues were not circulated or used or known after 1901, but the stipulation is limited to 1901 as the Oil Well Supply Company, of Pittsburg, Penn-

sylvania, issued a catalog of 1902, which it is conceded was published long after the date of the application for the Double patent in suit, although such 1912 catalogue contains these same exhibits, "Defendant's Exhibit Page 82 Oil Well Supply Company's Catalog of 1900," and "Defendant's Exhibit Fig. 2161 Oil Well Supply Company's Catalog of 1900."

It is further stipulated and agreed that page 80 of the said Oil Well Supply Company's Catalog, with stipulations similar to the foregoing in regard to its date of publication and distribution, is offered in evidence and marked "Defendant's Exhibit Page 80, Oil Well Supply Company Catalog of 1900."

It is stipulated and agreed that the underreamer marked [290] "Defendant's Exhibit Sample of Swan Reamer" is a substantial embodiment of the construction and interrelation of parts shown and described in "Defendant's Exhibit Swan Patent 683,352" and that the device marked "Defendant's Exhibit Sample Austrian Reamer" is an embodiment of the "Defendant's Exhibit Page 82, Oil Well Supply Company's Catalog of 1900," with the omission of the key which is shown in block in Figure 1713 just above the cutters and froming a block above such cutters, and with the omission of the spring-actuated mandrel and spring and with slight modifications in the forms of the cutters or bits from those shown on such page 82.

Testimony of John O. Dart, for Defendant.

JOHN O. DART, called as a witness on behalf of defendant, deposes and testifies:

My name is John Oscar Dart, age, 48 years; oil well driller. I have been connected with the oil wells in all capacities and have been drilling continuously up to the first of January last. I am familiar with underreamers. My first experience was with the Austrian Underreamer. I have had a whack at them all ever since. The Double, the North, and the Wilson, and old Leidecker—preceding all those—one Mel Kellerman got up, one we called the “Old Betsy.” That never was very successful, but then I had a whack at it just the same. I can’t state as to just what dates I used each and every underreamer; but right along, two or three times a year at least ever since 1897. I have been using different underreamers weeks at a time, months at a time. A fellow by the name of Ed. North, at one tie with the Pacific Coast Oil Company, when I first knew him. He is a lame man and he got up an underreamer down here that I used in 1901 and 1902, and later. I don’t know, forget his initials. Ed. North is what he is known by all over the State. I don’t know that it is very much different from the general principle of the Double and [291] Wilson. There was a set of lugs resembling these here, somewhat; held in place by a spring, and that was pulled down, with the exception that there was a block in the center in here. (Witness points to space between the cutters in “Defendant’s Exhibit Double Underreamer.”) I used

(Testimony of John O. Dart.)

it in Coalinga on the Westlake Rummel Oil Company property. It was in the fall or winter of 1901 and 1902. I underreamed quite a bit with it. It underreamed a very hard shell and I carried the casing down to the depth that the company required. I used a good big regular drilling stem on it and North instructed me to "Give it h——; I want to see what it will stand," and I did; and it stood it. It underreamed the shells and the pipe went down. I later used a $7\frac{5}{8}$ North Reamer in the early part of 1903. I used it for The British California Oil Company. We had just one bad shell to ream about 16-feet thick, we underreamed it and put the casing down.

I had no trouble with either one of those North reamers. I have since endeavored to obtain North reamers as I like them; I thought well of them. I would go to the supply houses to rent one of them and they would not have them in stock. While working for the Eastern Consolidated Oil Company at Gaviota I had occasion to need an underreamer; I telephoned to the Fairbanks-Morse Company at Santa Maria and Los Angeles and they did not have one. I telephoned to the Oil Well Supply Company. None of them had a North underreamer in stock. In my opinion the North underreamer at that time was the best underreamer on the market. At that time there were the Leidecker underreamer, the Austrian underreamer and the Double reamer all obtainable which was in 1904. That was when I was working for the Eastern Consolidated Oil Company. I finally got a Double reamer and used it.

(Testimony of John O. Dart.)

At the time I used the North underreamer in 1901 and 1902, [292] the Double underreamer was scarcely perfected. I corresponded with North in 1902 about his underreamer.

(The letter referred to is offered in evidence as "Defendant's Exhibit Letter John O. Dart to Edward North, of March 15, 1902.")

My last drilling was last January in Maricopa; I used both Double and Wilson underreamers. I liked the small sized Wilson underreamer better than the Double. I prefer the small size Wilson to the small size Double. I have used many Wilson reamers. I always use them in a small size hole.

I have never broken or lost any part of a Wilson underreamer.

The North underreamer that I used had two latches. At the time I inquired of Fairbanks-Morse for a North underreamer they told me that they were not being manufactured, that they were not in stock and they advised me to use the Double.

I found no difficulty whatever in using a North underreamer. The Leidecker reamer I used was substantially like "Defendant's Exhibit Swan Patent, 683,352." I used to have a great deal of trouble getting it into the pipe at the bottom. After reaming for a while I would nearly always have to jar it into the pipe; it was not satisfactory, compared with the reamers of to-day. Referring to the difficulty found with the Kellerman reamer. Well, it was—had a hell of a time getting it down and a worse time

(Testimony of John O. Dart.)

getting it back; never was a success. I don't think we ever did any reaming with it.

The Austrian reamer was certainly better than no reamer; it was the first that we ever used in this field; the first that was used, I believe; the first I ever saw used in California, although I believe there may have been others—I am speaking from my own experience. The chief trouble with the Austrian was [293] that the dogs or cutters were so light that we would break them off; continually breaking them off. Also the cutting surface was narrow, such a small segment of a circle; very slow reaming; and frequently it would what we call key-seat the hole; would not have near all the hole underreamed and the pipe would not fall.

The trouble which Mr. North states he had with his underreamer when he states that the cutters had to go too far below the casing before the cutters were sprung into operative position;—"in some cases where there would be, as near as I could figure it out, a small cave just below the casing, the cutters would throw apart and catch, and perhaps on some protuberance there, and the weight of the tools would come down on that and pry the T-head off the spring-rod and leave the cutters in the hole," and all because he run his reamers too close to the pipe. The remedy for that trouble would have been to get a new driller.

Testimony of Martin Barber, for Defendant.

Barber testifies and states as follows:

My name is Martin Barber; resident of Los Angeles; age, 56 years: Occupation, oil and refining. I have been in the oil business about 18 years. Have done everything connected with it. Have for the last 14 years been general superintendent of all the Santa Fe Oil Co's property. Have done actual drilling myself; yes, sir. I am familiar with underreamers. Have used the Austrian underreamer, the Swan, or Leidecker, the Fox underreamer, the North, the Double. Used the North underreamer in the Fullerton field in 1902.

Q. 9. What did you do with the North reamer at that time and place?

A. Well, we underreamed holes with it.

Q. 10. How many holes, approximately?

A. Oh, used that in a half dozen different holes, I [294] guess.

Q. 11. What results did you get?

A. Same as with all of them. They were good as long as they were made so they would go down in the casing all right and and pull out all right. Some of them, after they were used a while, they become worn and would have a hard time to get them down the hole and a hard time to get them back out.

Q. 12. What reamers do you refer to in making this criticism? A. All of them, at that time.

Q. 13. What other experiences did you have in using the North reamer?

A. Well, when we first got it it was an improve-

(Testimony of Martin Barber.)

ment over any thing that we had ever had, and we come to the conclusion we had struck the right reamer; and as I say, later on, it began acting bad, then we come to the conclusion there was defects in that that should be remedied. We reamed with North reamers about 2,100 feet deep. We did not run the North reamer very long, probably four or five months. It is like reamer as disclosed in Patent No. 674,793. I wrote a letter to Mr. North recommending the North underreamer. That letter was the truth at that time, as far as I knew.

We had difficulty with this Swan or Leidecker reamer, both getting into and out of the hole. I could not tell exactly the reason, only it was not made right. It did not give satisfaction, no, in either of them nor the Austrian.

The Austrian underreamer or the Swan reamer would all ream when you got them down, and they enabled us to get the casing down. The worst part of them was getting them down, and into the casing again.

(Defendant's Exhibit Letter of March 19, 1902, Martin Barber to Edward North here offered.) [295]

**Testimony of W. W. Wilson, for Defendant
(Recalled).**

W. W. WILSON—Testimony Continued.

Referring to the O'Donnell and Willard underreamer, and patricularly to that portion which is wedge-shaped and which forms the partition between the cutters, which partition is designated as "3" in the patent,

(Testimony of W. W. Wilson.)

When the bits are in the collapsed position their inner faces rest against the lower end of the partition 3, and in expanding as the bits move upward over this partition the partition causes them to spread apart, due to the material that it introduces between the cutters.

The taper of the bore allows the upper ends of the shank to spread outward, causing the points of the cutters to tilt inward by their tilting action over the lower end of the wedge-shaped partition.

If the wedge-shaped partition, or that portion of it just about the circular showing of the spring pressed bolt 16, were cut away, the expansion would then be due solely to the tapering action of the pocket in which the cutters lie. The cutters would then be pressed inward against each other and fulcrum near the lower end instead of having this fulcrum acting over the rounded surface over the lower end of the wedge-shaped partition 3, the cutters on being drawn down would contract due to the movement outward of the upper ends of the shanks on the tapered faces of the bowl of the body, and on moving upward would expand due to contraction of the upper ends of the cutter shanks and the moving of the cutters against each other at fulcrum point near the bottom.

The swan underreamer expands by having the cutters move upward and on outwardly inclined faces on the reamer body. With the O'Donnell & Willard the cutters fulcrum over the lower end of the partition 3, part of the expansion being caused by the

(Testimony of W. W. Wilson.)

[296] cutters moving up over this partition and part of it being caused by the upwardly inwardly tapering pocket in which the cutter shanks move. It is also somewhat similar to the Swan in that a portion of the expansion is occasioned by the tapering wall or partition. In the Swan underreamer the cutters do not tilt, as the O'Donnell & Willard underreamers cutters do. The mode of expansion of the cutters in these two devices is not the same. The only similarity being the expansion caused by tapering ways. With the Wilson underreamer there is no expansion of cutters caused by the dovetail as they are parallel, consequently can give the top of the cutters no tilting and thereby cause expansion. The dovetails on the upper ends of the shanks of the cutters are at all times in contact with the dovetails on the body, but that contact produces no expansion.

Q. 388. Permit me to interrupt you, Mr. Wilson, but also answer with relation to the absolute elimination of dovetails.

Mr. BLAKESLEY.—That was the question, wasn't it?

Mr. LYON.—That was the question but—

Mr. BLAKESLEY.—He means if the dovetails were entirely removed.

A. Oh, I thought he meant the tapering action. (Questions Numbers 386, 387 and 388 read by the reporter.) If the dovetails (of Double reamer) were removed there would be no means of holding the cutters against the body, and they would be lost in

(Testimony of W. W. Wilson.)

the hole. And also in soft formations there is a tendency to spread the lower ends of the cutters apart when the blow is struck. There would then be no means of retaining the cutters against this action; they would soon spread apart and be lost. Therefore, dovetails, or some means of limiting the outward movement of the shank of the cutter, is necessary to the operation of the reamer. Should there be dovetails used, but such dovetails placed so as to produce no expansion of the cutters, the only way that this [297] could be done would be by making them parallel to each other and to the axis of the reamer body. The sole expansion of the reamer would then be by the wedge or spreading shoulders at the bottom of the hollow slotted extension, which would reduce the expansion of the cutters by the amount caused by tapering these dovetails. The only way expansion could be increased would be by the thickening of the partition placed between the cutters on the body expanded, which thickening would leave less room for the shanks of the cutters. Also to allow for expansion a deeper notch would have to be cut in the back of the cutters, thus greatly weakening the shanks of the cutters. In the drilling nowadays, particularly with the smaller sized reamers, it is necessary to have a large amount of expansion of the cutters, because the reamer must go down inside the pipe and expand so as to cut a hole large enough for the collars to follow; and the big, heavy pipe or casing used nowadays make these differences in the diameters of the inside of the pipe

(Testimony of W. W. Wilson.)

and outside of the collar very material. Hence, in the Double reamer as shown, the expansion caused by the dovetails being tapered is very important and necessary to give the cutters strength sufficient in the shanks and also cause the cutters to expand properly. In the Wilson underreamer, this difficulty is avoided by the great width possible to make the spreading bearings without limiting or weakening the cutter shanks.

Q. 389. (By Mr. LYON.) Read the witness the question once more and see if he has answered it as fully as he can or desires to.

(The questions numbers 386, 387 and 388 were read by the reporter.)

A. It is certain that a great difference in the comparisons would be made by the elimination of the expansion of the dovetails in the Double underreamer patent and exhibits. This would give to the cutters an entirely different tilting action and its expansion would then become more of a pivotal action to the cutters; [298] in fact, it would be quite a different underreamer in principle from that shown in the patents and exhibits; and in so far as this expanding action is caused by the tapering of the dovetails would vary the answers given to that extent; and I believe, under our modern requirements for reamers, would render the tool impractical except for light reaming.

The dovetails on the reamer body of the Wilson reamer in a degree cause or compel the shanks of the cutters to travel in a definite line and in that respect

(Testimony of W. W. Wilson.)

coact with the swinging action of the cutters and thus guide the shanks of the cutters to expanded position, however they lose no inward or outward movement of the cutter shanks.

I have produced a drawing of hypothetical underreamer, which I have designed, in which I produce a thin film of metal joining the prongs of the extension of the Wilson reamer, the same being at the outer periphery of the body and which also does away with the dovetail shoulders, both on the reamer body and on the cutters. The strength of these cutters would be about 9-16th of the strength of the Standard Wilson underreamer cutters. However the reamers could be constructed with stronger cutters and heavier shanks.

I believe the North improved underreamer, as exemplified by the circular of the North improved reamer, would be an operative underreamer and practical. It might not be as strong as the late style underreamers.

I think the Jones patent reamer would probably give more trouble in getting it in or out of the casing than the original North reamer, as shown in the Union Oil Tool Co. circular.

Q. 424. Are we to understand you, Mr. Wilson, as testifying that the inter-engaging shoulders or dovetails on the Wilson reamer, either as shown in "Complainants' Exhibit Wilson Reamer" or in "Complainants' Exhibit Wilson Underreamer No. 2," perform no part in the expansion of the bits?

(Testimony of W. W. Wilson.)

A. Yes, sir; I cannot see where they perform any part in the operation of the expanding of the bits of the Wilson underreamer, they being parallel, and any movement up or down would make no difference in the expansion of the cutters.

Q. 425. Then, if you cut off the side shoulders or dovetails from the shanks of the bits of such Wilson underreamer, the bits will expand in identically the same manner as in such exhibits as now constructed?

A. No, sir, they confine the shanks of the cutters to certain zones of movement, however, add nothing to the expansion movement of the cutters or movement outward of points of the cutters.

Q. 426. Explain fully on the record what the movements last referred to by you as effected by these dovetails in the Wilson reamer are.

A. In expanding or collapsing of the cutters, the dovetail shoulders confine the movement of the pivotal axis, which is at the intersection of the planes of the outside of the dovetail shoulder and that of the beveled upper portion, to vertical lines along the body.

Q. 427. In answer to question 382, in reference to the Double underreamer, you say, "The elimination of the dovetails referred to would eliminate the expansion of the cutters due to the cutters traveling in the inwardly upwardly tapering dovetail ways and would therefore eliminate this portion of the expansion of the Double underreamer." Please state definitely what portion you refer to in this answer.

A. The way that question was put, it was hard

(Testimony of W. W. Wilson.)

for me to imagine an underreamer being made operative under those circumstances.

Q. 428. Is that the best you can answer?

A. No, I will fix that. However, without the tapering dovetail ways on the body, tilting action would be difficult to [300] attain unless some other means were provided to allow for the tilting of the cutter shank due to the engagement with the dovetail ways. This would, of course, eliminate the expansion caused by this action in the operation of such a supposed underreamer.

Q. 431. What, in your opinion, then, would be the result in [301] the Wilson reamer, if the inter-engaging dovetails of the body and shanks of the cutters were removed with respect to the expansion of the cutters as defined by you in your last answer?

A. Some means would have to be provided to hold the top ends of the cutters against the T-bar or in substantially the same position that they are held by the dovetails; however, the removal of the dovetails, providing the upper ends of the cutters were maintained in their relation to the T-bar as they are now, would make no difference on the expansion of the underreamer. That would not be the case with the Double underreamer. In expanding the Wilson underreamer cutters their sole means of expansion is the inclined faces or spreading bearings at the lower ends of the prongs of the reamer body. With the Double underreamer the cutters are expanded partly by the spreading wall or partition or namely the lower end of the hollow slotted extension, and

(Testimony of W. W. Wilson.)

partly by the teetering action of the cutter on that partition due to the upper end of the cutter following the upwardly and inwardly inclined dovetailed ways. When the cutters of the Double reamer are in completely expanded position they can get no further apart, and they cannot ride up over the wedge-shaped or inclined spreading surfaces without getting to this completely expanded position. This is also true of the Double reamer.

A. 442. Yes. However, in the expansion of the Wilson underreamer, the expansion due to thrusting the lower tips of the prongs between the cutters is their sole means of expansion. However, in expanding the Double underreamer, this means of expansion has added to it that caused by drawing the upper ends of the cutters together by the tapered dovetail ways and rocking them over the fulcrum which is near the center of the cutter where it bears against the point of contact with the hollow slotted extension, causing further expansion of the cutting points.

The upper end of the Wilson underreamer cutter namely that portion above the suspension means, move, due to the tilting action [302] of the cutter which is caused by the slight bevelling of the dovetail, slightly toward each other as the cutters expand, but that motion is caused entirely by the spreading bearings at the lower end of the prongs, which swing the lower ends of the cutters outwardly and at the same time throw the upper end of the cutters inwardly, namely that portion of the cutters which is above

(Testimony of W. W. Wilson.)

their suspension means. That swinging action at the upper end of the Wilson cutters when collapsing or expanding is merely the effect of [303] interposing the wedge-shaped projections of the lower end of the prongs between the cutters and spreading them apart at the lower end and *vice versa* on collapsing. Movement of the cutter in tilting outward causes slight inward movement of the upper end of it. The amount of this movement will vary in degree with the distance at which the pivot point varied from the top of the cutter." With a Double underreamer that action is entirely different as the Double underreamer cutters, while sliding on their suspension means, namely the key, at their upper ends, travel inwardly due to the inclination of the dovetailed ways on the reamer body which in turn expand the lower ends of the cutters, namely that portion of the cutters beyond the fulcrum part on which the cutters rest at their spreading bearing. That action is entirely different from anything found in the Wilson underreamer cutter. With the Swan underreamer the full length of the dovetails on the cutters engages the inner faces of the dovetails on the body throughout the entire length or travel of the cutter. With the Double underreamer, the dovetails being tapered downwardly and outwardly allow the cutter-shanks to bodily move outwardly as the cutters go downwardly into collapsed position, causing further collapsing of the cutter by reason of its tilting over the fulcrum near the lower end of the shank, and the outward swing of the cutter at its upper end. With the Wilson underreamer the dove-

(Testimony of W. W. Wilson.)

tails of the body control the pivotal point of the cutters so that the upper end of the cutters at the fulcrum point cannot swing outwardly or inwardly as the cutter collapses or expands. This is due to the fact that the Wilson underreamer cutters travel in parallel dovetails.

The Wilson underreamer is the only one the dovetails of which are solely for the purpose of holding the cutters in the reamer body. With the Swan and the Double underreamers the dovetails [304] on the reamer body perform a dual function namely retaining means and also expansion means. The O'Donnell & Willard reamer and also the Double reamer employ the upwardly and inwardly inclined retaining means as an expansion means, as well as a retaining means. The underreamer disclosed in my hypothetical drawing would as far as I am able to learn be a practical reamer.

(Complainants offer in evidence the drawing referred to and known as the "Hypothetical Reamer" and ask that it be marked "Complainants' Exhibit W. W. Wilson Hypothetical Underreamer Drawing.")

With the hypothetical reamer the riding point of the cutters against the inner walls of the casing would be lower than the corresponding bearings on the Wilson underreamer cutters. This however would make no difference in the results. [305]

Testimony of Thomas A. O'Donnell, for Defendant.

Mr. O'Donnell testifies as follows:

My name is Thomas A. O'Donnell; age, 42; residence, Los Angeles; occupation, oil producer. I was

(Testimony of Thomas A. O'Donnell.)

born in the shadow of an oil derrick in the State of Pennsylvania. Have been actively engaged in the oil business in California for twenty-three years. I know of nothing in connection with the business with which I have not had experience. I am president and general manager of the American Oil Fields Company and of the American Petroleum Company, and a director and owner in several other companies. President of a few smaller companies, and vice-president and general field manager of some of the companies.

I am familiar with underreamers. I have used the Austrian underreamer quite extensively in the early 90's. I am also familiar with the Swan underreamer. I have used a reamer which myself and Mr. Willard patented. I then used the Double reamer and the Wilson reamer. I think I have also used the Plotts reamer.

Q. 19. Yes. Start in, please, and tell us about the beginnings of the invention, and anything you have to say with respect to it, in the early stages of it.

A. At the time that I became interested in this reamer, Mr. Arthur Willard was a machinist working in the Baker Iron Works. I was a producer and contractor and had a great deal of work done in that shop. Mr. Willard, at some time that I would place somewheres between the years '97 and '99, presented me with some drawings that he felt would eliminate the difficulties that we had in the use of the Austrian reamer that we were then using most extensively and with which we had had various kinds of difficulties.

(Testimony of Thomas A. O'Donnell.)

And the first set of drawings, as I recollect it, did not seem to me to be practical, and I made some suggestions to him, and he presented a second set of drawings. I think at that time that he [306] asked me if I would not put up the money and try to go in with him and devise a reamer that would be an improvement on the reamers then existing, and I told him I would, with the idea that he would submit it to me and I would pass my judgment, first, on whether it would be an improvement or be workable when it was completed. I don't remember any of the details leading up to that arrangement, except that I was to put up the money and did put up the money and helped him in the planning of it. We then got some drawings that appeared to be satisfactory to both of us, and had a model made. My recollection is rather dim in connection with the model, but it seemed to me at that time it was necessary for the patent attorneys to have a model from which to make drawings or submit proper authorities. We then figured on making one of the machines themselves, and about that time some traveling salesman for a tool house, a manufacturer, in the east—and my recollection is that he was interested in some way with the Swan reamer—was trying to sell me Swan reamers; and I showed him this model, and was able later to make one of them. He seemed to be much impressed with it, and I made an arrangement with him to buy a reamer through the W. T. McFie Supply Company. That reamer was to be according to a model that I then had, of 75/8. The model was

(Testimony of Thomas A. O'Donnell.)

shipped to them, and there were several months intervening before this reamer was shipped to us, and various excuses advanced for delay. I think I received the reamer in 1900, along about September, the 1st of September, or October. I would not be definite as to exact dates. Of 1900. That reamer I used out here in the local fields on several different occasions. At the time that I got the reamer, I had a number of Austrian reamers. And the reamer, from the commencement, after the knives got worn, gave us a great deal of trouble getting it down the hole. The occasions on which I used it I generally personally supervised the use of it, to become familiar with its defects, if any, and to make a successful operation; and [307] it occurred where we had very hard shells we desired to ream right in the bottom where we could not use the Austrian reamer with success. The first reamer created a great deal of enthusiasm in myself for its future, and I rented it to some parties that I am now unable to call their names—I have tried to see if I didn't have any records leading up to their names—that were operating up around the Newhall district that had some very heavy reaming to do, and they paid me a rental on the machine and seemed to be very much enthused about it. I then had Arthur Willard, who was working for the Baker Iron Works, make another; and this one was 95/8. It was necessary, in order to have this done, for me, in order to place it with the Baker Iron Works, to have the work done and request them that Willard be permitted

(Testimony of Thomas A. O'Donnell.)

to work on it. He was working there for a salary at the time. That reamer I intended to use down at Whittier, where they are drilling some wells that had some very hard underreaming in.

Q. 20. Let me interrupt, for the purpose of putting a question just at this point, and ask you if you recollect when this order for this second reamer was placed with the Baker Iron Works.

A. I can't recollect the dates, not even the month, except that it was shortly after we were done experimenting with and using the $7\frac{5}{8}$. It was in the fall of 1900—the summer or fall of 1900.

Q. 21. Now, please continue.

A. I was interested in Whittier at that time in what was known at that time as the Fidelity Oil Company. I had associated with me a man by the name of Harris, and Mr. Harris was interested in an oil company named the Mora or Elmora. I am not sure which. I was not personally interested in this well, but they had some $9\frac{5}{8}$ casing in their hole which they could not underream with the reamers which they then had, and as this reamer was just finished [308] I ordered it shipped to them and myself went up there and underreamed this particular shell that they had trouble with. The reamer was then moved down to my own property that was about half a mile from that property, on which I was drilling two wells. We had in use on those two wells some of the old Austrian reamers, but at least three occasions that I remember quite well we used the $9\frac{5}{8}$ on the hard shells that we had at that point. One of the

(Testimony of Thomas A. O'Donnell.)

principal difficulties in the construction of this reamer was the tendency of the knives to wedge and hold up in going down the casing and after they became worn and it became necessary to dress them we had to tie them with ropes and wedge them with sticks to get them in the hole, which caused considerable annoyance. On the finishing of those two wells, I was also interested in a property known as the Alliance Oil Company—in fact, I was the principal owner of it; afterwards paid its debts—drilling a well at the mouth of the San Fernando Tunnel. The formation at San Fernando Tunnel is a great deal of granite and limestone—very hard—and in view of the difficulties that I had had in getting this reamer in and out of the hole out at Whittier—well, into the hole; no difficulty in getting it out—I advised Arthur that it seemed to me to be necessary for us to devise some scheme to hold those knives down without the necessity of tying them and wedging them with sticks; and he devised a plan that consisted of a collar acting as a sleeve on top of the reamer, with projections of some kind that I am not now familiar with running down to these knives to hold them down while it was passing through the casing. They were using $9\frac{5}{8}$ casing at this Alliance well and I sent this reamer up there with the new appliance on it for holding the knives down, and advised Mr. Willard that I would like to have him go up and show my drillers what his ideas were in holding the knives down; and he done so. I was up there a couple of days afterwards myself and they had been working

(Testimony of Thomas A. O'Donnell.)

with [309] the reamer nearly continuously for that two days but had succeeded in underreaming some very hard limestone, I think it was, or granite. It was about as hard—it was one of the hardest formations that I ever drilled a well in in California. But he was experiencing a great deal of difficulty, principally with the sleeve on top of it, with the sand getting back of the sleeve and preventing its free working and it was necessary to be very careful and have that washed out very carefully, and I stayed up there a couple of days myself to assist him in overcoming that difficulty. My judgment was then, and is yet, that the sleeve was no improvement at all and was a detriment. That is the story, as it appears to my mind in just thinking it over. I have not had the opportunity I would like to have had to look up these matters. I have been very busy with other things.

Q. 22. Can you state what became of the first of these O'Donnell & Willard underreamers which you used?

A. Well, I had ambition to make money then, to get some of my money back, by renting it around San Fernando, where they had difficult underreaming, and it was used up there, and my recollection is that I had sent it down to the Baker Iron Works to have some more knives made for it or the bowl bored out. It had become very badly worn. I don't remember ever doing anything more with that particular reamer.

I do not know where it is now. The second O'Donnell & Willard underreamer was moved from the

(Testimony of Thomas A. O'Donnell.)

well that was built at the mouth of the tunnel down to the local field here. It was put into a storehouse that I had out here for accumulated junk. It was not immediately moved to the place I have in mind. The well at San Fernando Tunnel was a failure and all of the material was moved down to a lease that I was interested in called the Hubbell Lease that is out adjoining Sixth Street about two blocks west of Westlake Park. I had a general storehouse that was on [310] Bonnie Brae Street, called the O'Donnell Oil Company storehouse, and at various times my tools and equipment was picked up and carried to that storehouse, and among it this reamer, and it remained there until recently. I saw this O'Donnell & Willard reamer at the shop of the defendant the other day. Mr. Arthur Willard pointed it out to me. He said. "That looks like the old girl, doesn't it, that we used to monkey with"—something like that. It was tagged "Defendant's Exhibit O'Donnell & Willard Underreamer."

The O'Donnell & Willard underreamer now under discussion with the witness is again to be offered in evidence as "Defendant's Exhibit O'Donnell & Willard Underreamer."

William Grant Lehman was one of the drillers at Newhall who operated said second O'Donnell & Willard reamer. I don't know the other fellows' names. Mr. Lehman was with me a great many years. The other men were not permanent. I saw Mr. Lehman here in Mr. Blakeslee's office a few minutes ago. He is superintendent for the Bellridge Oil Co. in Kern County. I do not remember the depth we went with

(Testimony of Thomas A. O'Donnell.)

the second O'Donnell & Willard reamer. Out at Whittier I am unable to state the depth of the Mora or Elmore hole, but I would say it was approximately six or seven hundred at the time the reamer was used. The two wells in Whittier, about eight and nine hundred. I have no recollection as to the thickness of the shells you drilled through with this second O'Donnell & Willard underreamer. On account of the difficulty of getting it in and out the hole, I used it principally on hard difficult shells with the Austrian reamer. The Austrian reamer we had in use—our difficulty with that was that it was hard to ream directly in the bottom on account of it having a projection below and the hard [311] shells would prevent its proper working; and then, again, when the shells were hard, it would dodge off of them and cut key-ways through the shell. And it was only in those cases that I used this reamer during that time, that is, where I could not get along with the Austrian. I never did attempt to ream any shells that I could not get through them with the O'Donnell & Willard reamer. I had a great deal of difficulty with them, but I always got through the shells that I started. Well, the Newhall district, particularly where we were working there, which was an error in judgment as to location, is one of the most difficult wells that I ever did drill, the hardest formation—practically solid rock standing on end. It is at this end of the tunnel, to the left going into the tunnel, very close to it. The formation that the well was drilled in is not the same formation that is in the tunnel. The well was drilled on some reefs

(Testimony of Thomas A. O'Donnell.)

that ran clear across the country this side of the tunnel, so my judgment would be that the formation in the tunnel would be no comparison at all with what the well was drilled in.

The first heavy casing same into use I think in about 1903. I used wire drilling line as early as 1895 or 1896, but it was generally supposed it could not be done. But I used wire line about the time I was experimenting with the O'Donnell and Willard reamer.

The calf wheel came into general use in about 1904, it was experimented with and used quite frequently before that time.

About four or five years ago I had another O'Donnell & Willard reamer made by the Wilson & Willard Mfg. Company. It was taken to Coalinga. We used it some out on the Octave Oil Company lease. I am not sure whether it is the Octave Oil Company now. We didn't get any better results than we got from our former reamer. The partition for holding the knives down didn't work any better than the former one did. The reason I dropped it at [312] that time, I took charge of other big properties and I didn't consider it was fair to the people I was working with to do any experimenting with it; I would rather leave it to somebody else, so that I could not be criticised for it. That was the reason I left it at that time. I thought I was going to work up there in which I could use it, but I changed my plans.

Q. 85. What can you say for your reasons for not making any other O'Donnell & Willard underreamers between the time you brought the second one

(Testimony of Thomas A. O'Donnell.)

to the storehouse of the O'Donnell Oil Company and the time you made this reamer shipped to Coalinga?

A. Well, there were several reasons. In analyzing my actions in the matter, I sometimes think I was rather foolish not to do it. I was very actively engaged in contracting and producing, and using what money I had, and had a great deal of trouble financing myself generally. It costs some money to experiment. And Mr. Willard, who was interested with me, didn't have any money of his own; and that is one of the factors that entered into it. I am not an expert from a mechanical standpoint myself, and while the idea seemed to be correct in principle, there were many mechanical defects that I didn't feel like spending the money or the time in working out—in fact, didn't have the money if I conducted my other business as it should be conducted. Since that time I have been very actively engaged in the oil well development business, and managing oil well properties. During my entire time to the present date I have had all of my available capital employed in the oil business.

I have never done any manufacturing on my own account. It is only quite recently, namely the last two or three years, that we have had machine shops in connection with our companies.

I first used the Double reamer in 1904 or 1905. The Complainants' Exhibit Double Underreamer, is the reamer resembling the Doubles I have used. I think the Double reamer works much better than our original reamer did. [313]

(Testimony of Thomas A. O'Donnell.)

Q. 110. In either one, but the method of the operation, how each one works, and then compare the working of one with the working of the other.

A. There is a difference of construction in the lower end of these reamers. The knives in both of them pull down and collapse for the purpose of drawing them in to pass through the casing below a partition. The partition in the original reamer of ours was detached and screwed in, while Double's was made all solid into the body. The principle of operating the knives, being on the bottom, where we had been wanting to put them for years, for strength, and so forth, was the same in both of them. Some of the mechanical parts leading up to that operation is quite different.

Q. 111. Have you ever, in any way, had your attention called to the Double underreamer in connection with any aspects of the O'Donnell & Willard underreamer?

A. Oh, yes; you mean by somebody talking it over with me, or—

Q. 112. In any way whatsoever.

A. Yes; Mr. Willard always has claimed that the principle of these reamers was the same. I have more or less agreed with him. But the mechanical perfection of the final construction as they now are has been materially improved in it. At the time Mr. Double had a former suit, I think with the—well, I don't know whether it was the one with the National Supply Company or not, but he had a suit

(Testimony of Thomas A. O'Donnell.)

in connection with these reamers—I got a letter from some patent attorneys from Washington calling my attention to the suit and noting that the suit had been persistently fought and wanting to know if I considered it of any great importance, and that there was an allowance in our patent—in a patent that I apparently was interested in, was the way the letter read—that in their judgment there could be contention made in connection with both of the reamers then being contended for in the courts; and I passed it over, as I have all of my experimenting connections with it. I didn't care to enter into any suits in connection with it, [314] and dropped it. I don't know what their purpose was, or anything. Outside of that, the only people I know of discussing it very extensively with is Arthur Willard at various times; that I always felt would like to do some experimenting and have me pay for it.

Mr. LYON.—I move to strike out each and every portion and sentence of the foregoing answer from the record and exclude it from consideration, on the ground that the statements referred to are not binding upon the complainants, not made in the presence of any of the complainants, and are incompetent and inadmissible, and as hearsay and not the best evidence.

Mr. BLAKESLEE.—Attention is called to the fact that certain of the statements referred to in this answer were statements in discussion of the O'Donnell & Willard invention, made by Messrs. Willard & O'Donnell, each to the other, and that the witness

(Testimony of Thomas A. O'Donnell.)

has testified that he and Mr. Willard jointly produced an invention which was concerned in the production of the O'Donnell & Wilson reamers testified about.

(Mr. O'Donnell's testimony cont.)

I think the first Wilson underreamer I used was made in Bakersfield. I think I used a couple of them about 1906-7, with fair results.

As to the O'Donnell & Willard underreamer made in 1908 will say that I do not know how many times the reamer was run into the well. I was there when it was first run into the well, but was not there any more while it was used.

As I have previously stated my reason for making no further effort to use it or to give it any more time was that I thought I would be criticised for experimenting with it on other people's property. If we lost the cutters of that underreamer on the property where it was used I am not familiar with it. I have underreamer knives planted all over that lease. I do not [315] know what became of that reamer.

I don't remember of having any conversation with Mr. Thos. J. Griffith, in regard to that reamer. I will testify that I had no conversation with him in regard to it. The O'Donnell & Willard reamer was made in 1908 through Mr. Willard asking me to have another one made with some ideas he had about dishing the bowl to hold those knives down. I told him to go ahead and make one and send it to me and send me the bill.

(Testimony of Thomas A. O'Donnell.)

The companies that I am associated with are using Double reamers principally.

Q. 111. Have you ever, in any way, had your attention called to the Double underreamer in connection with any aspects of the O'Donnell & Willard underreamer?

A. Oh, yes. You mean by somebody talking it over with me, or—

Q. 112. In any way whatsoever.

A. Yes; Mr. Willard always has claimed that the principle of these reamers was the same. I have more or less agreed with him. But the mechanical perfection of the final construction as they now are has been materially improved in it. At the time Mr. Double had a former suit, I think with the—well, I don't know whether it was the one with the National Supply Company or not, but he had a suit in connection with these reamers—I got a letter from some patent attorneys from Washington calling my attention to the suit and noting that the suit had been persistently fought and wanting to know if I considered it of any great importance, and that there was an allowance in our patent—in a patent that I apparently was interested in, was the way the letter read—that in their judgment there could be contention made in connection with both of the reamers then being contended for in the courts; and I passed it over, as I have all of my experimenting connections with it. I didn't care to enter into [316] any suits in connection with it, and dropped it. I don't

(Testimony of Thomas A. O'Donnell.)

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Q. 151. Can you tell us the name of any one of the drillers or operators in or about the two Whittier wells that you drilled, or the Elmora Oil Company's well you had near Whittier, where you say this first O'Donnell & Willard reamer was attempted to be used?

Mr. BLAKESLEE.—Objected to as not in accordance with the testimony of the witness.

A. I answered the question by referring to the first

(Testimony of Thomas A. O'Donnell.)

one, which I didn't refer to as being used at Whittier. I have a recollection of one man in connection with the first one.

Q. 152. (By Mr. LYON.) Who is that?

A. Mr. Andrew Lester.

Q. 153. And that one was tried here in the Los Angeles fields, did you say? A. Yes, sir. [317]

Q. 154. What size was that reamer? A. 7 $\frac{5}{8}$.

Q. 155. What size was the second O'Donnell & Willard reamer? A. 9 $\frac{5}{8}$.

Q. 156. And who were the drillers that attempted the use of this reamer, either at the Elmoro Oil Company well or the two Whittier wells?

A. I can't call to mind the names of the drillers in connection with that well, with the exception of Mr. Lehman at the tunnel. That Elmora well, if that is the name—I am not certain of it—was not under my supervision at all, and I went up there myself to see the reamer underream, the shell that they had there, and brought it down to my own property.

Q. 157. Do you know a man by the name of Sam Frampton? A. Frampton?

Q. 158. Yes. A. Frampton?

Q. 159. Yes; F-r-a-m-p-t-o-n.

A. That name seems familiar.

Q. 160. Wasn't he one of the drillers or operatives at one of these wells at Whittier where it was attempted to use this O'Donnell & Willard reamer?

A. He might have been; yes.

Q. 161. Your recollection is not sufficiently definite to state positively?

(Testimony of Thomas A. O'Donnell.)

A. No. You will understand that I had under my supervision, and have had for a great many years a great many men, and it is hard for me to locate just the localities at which they worked and if it was not for the great interest I took in this particular reamer my own recollection would be entirely eliminated in connection with its use. [318]

Q. 162. Was this second or $9\frac{5}{8}$ O'Donnell & Willard reamer tried at all on the old Whittier Consolidated property at Whittier?

A. I don't think it was; no.

Q. 163. Do you know a driller by the name of H. Bailey?

A. H. Bailey? H. Bailey? I know a driller by the name of Bailey that worked for me a great deal. I can't recall whether his initial is "H" or not.

Q. 164. Did he work for you in the Whittier field?

A. Well, I am unable to give you the names of the men that worked out there at all. I won't attempt it, because I would get my mind confused and unintentionally make conflicting statements. It is a good many years ago.

Q. 165. Isn't it a fact, Mr. O'Donnell, that when you tried this reamer out in the Whittier field, you had a great difficulty in getting the reamer out of the well hole?

A. I never had any difficulty getting it out. I had lots of difficulty getting it in.

Q. 166. What was the difficulty due to?

A. It was due to, in my judgment, as I think of it,

(Testimony of Thomas A. O'Donnell.)

mechanical imperfections. The knives, while they were new,—if it had been profitable to run one and have new knives turned out as they come new, it would have worked all right. As the knives become worn a little on the head of them—or the back of them—and they were dressed around the derrick, we had a great deal of difficulty in getting them into the hole. We had to tie them down, put sticks—

Q. 167. You say that you never had any difficulty with any of these reamers in getting them out of the hole.

A. I never did. There might have been difficulty experienced as there is with all reamers. I have seen all kinds of them have trouble getting them wedged in the pipe at various times. I never seen one yet that was made that you didn't have [319] difficulty getting them out of the holes, and all kinds of difficulties with them.

Q. 168. Do you know Mr. L. C. Keyser, of Whittier?

A. I probably do, if he was at Whittier. I can't call him by name.

Q. 169. Isn't it a fact that he was one of the operators about the well when this O'Donnell & Willard reamer was used? A. In what capacity?

Q. 170. Employed on or about the well.

A. I don't know. But I would imagine, if he was, it was in some minor capacity, because the name don't seem familiar to me at all.

Q. 171. When was it that Mr. A. G. Willard de-

(Testimony of Thomas A. O'Donnell.)

vised this improvement of collar or sleeve with the projecting latches, and when was that put upon this second O'Donnell & Willard reamer?

A. That was about the first of the year 1901, about the time we started at the tunnel; and I have rather a distinct recollection of that.

Q. 172. You say that collar or sleeve on that device was no improvement but rather a detriment?

A. Oh, yes, I considered it of no assistance at all.

Q. 173. Did this 10-inch reamer that you sent out to Coalinga have on it the sleeve or collar?

A. No.

Q. 174. You discarded that device at that time, did you?

A. Yes; discarded the idea and the use of it at the tunnel well.

Q. 175. How long, to your own knowledge, was this 10-inch O'Donnell & Willard reamer used at Coalinga?

A. My own knowledge would not extend over an hour that I happened to be there at that time. The property was left in the charge of Mr. Lester and I was only there occasionally. [320]

Q. 184. Now, when you had this $9\frac{5}{8}$ O'Donnell & Willard reamer out at the Alliance well near Newhall, how many times, while you were there, was that underreamer run into the well hole?

A. Well, I stayed there the greater part of two days at one time in a hard reaming job, and they had difficulty with that collar, getting it in, and they were working the reamer the most of the time I was there.

(Testimony of Thomas A. O'Donnell.)

My general policy those days, and is up until almost the present time, whenever we have different difficult jobs around any of the wells, I get right in and take a part in it, take the drillers' end of it.

Q. 185. And how many times did you run the reamer into that hole during those couple of days?

A. Oh, I suppose twenty or twenty-five times. It was not always working right. We would pull it in and out, and had a good deal of trouble with it.

Q. 186. In what respect wasn't it working right and did you have trouble with it?

A. Had trouble with the sand getting in this collar and holding the knives down.

Q. 187. And what did that result in?

A. That resulted in making the tool ineffective in expanding the jaws when it got down below.

Q. 188. In other words, the jaws didn't expand?

A. Yes.

Q. 189. When those things happened?

A. Yes.

Q. 190. Do you remember how much you underreamed during those two days?

A. I think at that time we got in a joint of pipe that had been holding them up for some time, and I left when they were successful in doing it.

Q. 191. Then after using that O'Donnell & Willard underreamer [321] there at that time, when did you next use an O'Donnell & Willard reamer?

A. Well, I rather think that I went back there again and used the reamer; but I am not positive as to that.

(Testimony of Thomas A. O'Donnell.)

Q. 192. Do you remember of any other time using an O'Donnell & Willard reamer, after these two days that you refer to, until this 10-inch was made in 1908?

A. I can't recall that distinctly to my mind. I know that I did use the reamer out here in the local field, the 7 $\frac{5}{8}$, after it came back from up north; but to what extent I am unable to say, and in order to make my testimony regarding it effective in any way, it would be necessary for me to establish some dates or wells, which I can't do. In a general way, I know that I used it.

Q. 193. And what difficulties did you have in the use of that reamer?

A. We had the same difficulties in the use of that, getting down the hole; had to tie the knives and put the sticks in before we could do anything with it.

Q. 194. Approximately how much, all told, have you expended in connection with this O'Donnell & Willard experiment, Mr. O'Donnell?

A. Oh, I have had in my mind right along, probably not based on any figures at all, that it cost me about a thousand dollars—the patent and so forth. I have no correct statements of the cost.

Q. 195. Now, when was this two days that you tried to use this reamer at Newhall?

A. That was in the early part of 1901.

Q. 196. Can you tell us approximately when?

A. No; I cannot. I can tell you that it was within a month or two of that time. [322]

Q. 197. A month or two of what time?

(Testimony of Thomas A. O'Donnell.)

A. The first of the year.

Q. 198. To whom did you ever rent this reamer?

A. I have been unable to establish that definitely in my mind. Some people took it up around Newhall and used it, but I am unable to state definitely.

Q. 199. Have you any books or records which would show the rental of it?

A. No. Like a good many of the uneducated knockers around the field, I carried my books mostly in my pocket. To refresh my mind out loud, I can give some of my reasons for calling it to mind.

Q. 200. Well, what are those?

A. I sort of thought Arthur was rather enthused over the proposition and would like me to spend a little more money than I thought I was justified in doing, and this particular man around Newhall come telling me what a devil of a good reamer it was, and how much he had reamed with it, and it sounded a good deal to me like Arthur. I can remember the man very distinctly—I think if I should meet him on the street now I would know him—but at the same time I can't recall his name.

Q. 201. You didn't take much stock in what he said at that time?

A. Well, I didn't know whether he was telling the truth or not. He claimed he had reamed a great deal of hard rock up there and it was one of the best reamers he had ever seen.

Q. 202. And that was after your use of the reamer in Newhall?

(Testimony of Thomas A. O'Donnell.)

A. That was after my use of the $9\frac{5}{8}$. This is the $7\frac{5}{8}$ I am referring to. I had used the $7\frac{5}{8}$ quite a good deal around in the local field here and it always worked better than the one that Arthur made. [323]

It was in the early part of 1901 that we first used the O'Donnell & Willard underreamer. The $7\frac{5}{8}$ -inch underreamer—O'Donnell & Willard—worked better than the $9\frac{5}{8}$ one which we had in use at Newhall.

Am testifying in this case at the request of Mr. Wilson. I have had some conversation with Mr. Lehman and Mr. Blakeslee, also Mr. Wilson, perhaps others, in regard to this matter.

I am still the owner of a one-half interest in the O'Donnell & Willard patent.

Q. 212. Have any suggestions been made to you recently by any one that the Union Tool Company is infringing such patent in the manufacture of the Union or Double reamer? A. Yes.

Q. 213. By Mr. Blakeslee?

A. I don't know whether it was him or Arthur or Mr. Wilson.

Q. 214. You have talked that matter over, then, with one or more of them have you?

A. Yes.

Q. 215. And what was that conversation? [324]

A. Oh, it was kind of general. I have not—

Q. 216. What was said in that conversation in regard to the bringing of a suit on that patent?

Mr. BLAKESLEE.—Objected to as not cross-examination; and, in so far as it concerns the per-

(Testimony of Thomas A. O'Donnell.)

sonal interest of this witness in the O'Donnell & Willard patent and in any question of any infringement thereof, and in so far as any such talks were of a confidential nature, or were had in the sense of a discussion which might be considered as in the nature of advisory, formal or informal, witness is informed that he need not answer the question without the instruction of the Court. In such statement, I do not in any sense instruct the witness not to answer this question, but I merely notify him of his position in this matter and leave it to his own decision as to whether or not he wishes to answer the question.

Mr. LYON.—Read the question to the witness.

(Question No. 216 read to the witness by Special Examiner.)

Mr. BLAKESLEE.—You understand fully my remarks, Mr. O'Donnell?

A. Yes, I have nothing particular that I care to hide in connection with it. If they want to go into my personal affairs, they can go at it.

Q. 217. (By Mr. LYON.) Answer the question.

A. I was advised that I had some equities in the patent, if I cared for such a suit.

Q. 218. Is it not a fact that an effort was made by Mr. Willard to get you to bring, conjointly with him, such a suit?

A. No, sir; there was no such effort made, and it has not been talked seriously that I know of.

The Plotts underreamer operated quite as successfully as all the underreamers we had available

(Testimony of Thomas A. O'Donnell.)

at that time. That was between 1898 and 1902. We used it with a bit ahead of it. [325]

Q. 225. Did you get with this 10-inch O'Donnell & Willard reamer that was built in 1908 as good results as you got with either the $7\frac{5}{8}$ or $9\frac{5}{8}$?

A. No; I think not, because I didn't follow it up. I changed my mind after I went up there about experimenting with my own tools in companies where I was working for others. The $7\frac{5}{8}$ was used at a time when it was exclusively my own work and I was working in the derrick myself a great deal at that time.

Q. 227. When was the first time that you ever talked with Edward Double in regard to this O'Donnell & Willard reamer?

A. I don't know that I could recall the first time—if there is more than one, or two, or half a dozen, or whether I ever discussed it with him very much.

Q. 228. You remember discussing it with him, do you not?

A. Yes. He called to my attention the other day a conversation that he claims that I made to him, and I do recollect having a conversation along similar lines.

Q. 229. What was that conversation?

A. My recollection of it is—now, leading up to this point, I want to be particularly clear in there because I don't want to be misunderstood or question Mr. Double's remembrance of it. My recollection was that I called his attention to the fact that I had received a letter such as I had about the patent,

(Testimony of Thomas A. O'Donnell.)

and that brought up a general discussion and Double seemed to think that I was making or laying the foundation for—to attack his underreamer, and I told him I had no intention of doing anything of the kind, that I was playing my end of the game and he was playing his; he was in the manufacturing end and I monkeyed with the underreamer a little, and had had many difficulties in connection with it; he was a mechanic and—as more or less of a josh, as I remember it—had come along and took my ideas and made them mechanically perfect, and as long as he played the game fair I [326] would not interfere with him.

Q. 230. Is that all of that conversation that you remember?

A. That may not be the conversation at all. That is the trend of the conversation as I remember it. I could not, to save my life, give you the exact words of it.

Q. 231. Didn't you at that time tell Mr. Double that you had blown in a lot of money on that O'Donnell & Willard experiment trying to make something out of your ideas and the ideas of Mr. Willard but that you never had gotten anywhere to any successful result, or words to that effect?

A. Well, now, my remembrance is just what I am telling you about. That is pretty close to the conversation in connection with it. I don't see why I should at that time or at any time later give Mr. Double anything if I had it, and it was perfectly good will that we were talking, and general conver-

(Testimony of Thomas A. O'Donnell.)

sation—no bargain made for anything or anything given for any statements that I might make. It was merely a friendly conversation, started by me, as I remember it, in a josh, about this letter that I received in which some attorneys had told me that we had a patent to both of the reamers.

Q. 232. And the statement substantially as I have last made it is substantially as you remember the conversation?

A. No; I made the statement substantially as I have made it—substantially as I have made it so far as my recollection goes.

Q. 233. Then, will you answer whether or not you used the words I have indicated, or substantially those words, in that conversation?

A. I will say that I have no recollection that those are the substantial words.

Q. 234. Did you not tell Mr. Double in that conversation, in either direct words or words to the effect, that the experiments that you had carried on with what you have here termed the [327] O'Donnell & Willard underreamer had not proven anything to you and had not been sufficiently successful for you to say that the reamer was a success?

A. Well, you are going into a lot of words there. Of course my answer to that is that the general conversation was along the lines that I had spent money and was not interested at that time in building an underreamer and had no desire to stop him building it, or anything else. As far as I was concerned I considered he had made a mechanical success out

(Testimony of Thomas A. O'Donnell.)

of it and I would go ahead and buy his reamers—would not bother with it.

Q. 235. And at the same time you said he had made a mechanical success of it, didn't you state that you and Willard had not made a success of it?

A. Yes; sure, sure. I thought we had the principle all right there and if we had followed it up and carried out some of the details, it would have been all right.

Q. 236. As a matter of fact, neither you nor Mr. Willard, so far as you know, have ever carried out those details of that, have you?

A. No. We made those attempts during that time.

Q. 237. Then, summing it up, isn't it a fair statement, Mr. O'Donnell, to say that while you made these experiments with the O'Donnell & Willard reamer, you never yourself got that reamer to such a point that you considered it a practical or successful reamer?

A. The reamer, up until the time that Mr. Double and Mr. Wilson finally perfected their reamers, in my judgment, was as good as anything that was on the market at that time. The later mechanical perfections of them is far superior to that reamer—there is no question about that.

I have a distinct recollection of having made three O'Donnell & Willard reamers and I might have made another one—a $5\frac{5}{8}$. [328] —I do not know what has become of the other O'Donnell & Willard reamers. The occasion for building the 10-inch

(Testimony of Thomas A. O'Donnell.)

O'Donnell & Willard reamer at the Wilson & Willard Manufacturing Company's shop was: Merely Arthur Willard's request. He thought he had an idea that would eliminate some of the difficulties I had with it. Arthur Willard and I discussed these difficulties a good many times. We never built a reamer with the tripping mechanism shown in the O'Donnell & Willard patent. My idea of that is that it would be inoperative. Arthur thought it would work. My recollection is that I sent the first O'Donnell & Willard reamer, the 7 $\frac{5}{8}$, in 1901 from San Fernando, down to the Baker Iron Works to make some changes that Arthur had in mind, and then I changed my mind about it and took it out in the field and used it some, and then sent it back again to the Baker Iron Works, probably a year afterwards. That would be in 1902. After that nothing was done with it. I kind of dropped it. I don't know what became of it.

We had more or less trouble with all reamers in getting them into the casing so they will go down the hole, including the O'Donnell & Willard, the Double underreamer, and the Wilson reamer.

The principles of the O'Donnell and Willard underreamer and those of the Double underreamer are similar in many respects, although I think the Double reamer as it is constructed to-day does very much better work in getting it in and out of the hole. I would make the same comparison of the Wilson and the O'Donnell & Willard. I think both of them as constructed to-day are very complete reamers.

(Testimony of Thomas A. O'Donnell.)

STIPULATION.

It is hereby stipulated and agreed that the order book of the Baker Iron Works, November 1900, sales, shows the following order, the same being in the handwriting of Elihu C. Wilson, President [329] of the Wilson & Willard Manufacturing Company, and that the same be copied in the record of the Special Examiner, which is thereupon done as follows:

Order received.	Baker Iron Works,	Binder Folio 361.
Personally.	Los Angeles, Cal.	Date of Invoice.
Order No. Page.	Date, Oct. 29, 1900.	Nov. 21, 1900.
	Charge to Thos. O'Donnell.	(225 Hellman Block).
Salesman.	Ship to El Moro Oil Co.	Terms.
Alexander.	Whittier	212
Register Number	Ship via	Check
3856		C. L.

Filed By	Shipper's Quantity.	If BO.	Salesmen Must
	Check	Original	Not Use These
Shipped.	G.	Number.	Columns
Nov. 15, 1900.		Register.	Total.
	1 9-5/8	Under Reamer as directed	
	56-1/4	hr. Forge	1.50 84.38
	91	" Lathe	.80 72.80
	27	" Fitting	.65 17.55
	76-1/2	" Helping	.40 30.60
	6#	Spring Steel	.07 .42
	20#	Norway Steel	.07 1.40
	35#	Cast Iron for Spe-	
		cial tool	.05 4.25
	1002#	Soft Steel of	
		9-1/2#	.05 50.10
	306#	Hard Steel	12 1/2 38.25
			299.75

Testimony of William G. Lehman, for Defendant.

Mr. Lehman testifies as follows:

My name is William Grant Lehman; superintendent of oil property [330] at McKittrick. Age 48. I have been connected with the oil business since 1894. I am familiar with underreamers. I have used the old Austrian reamer, the Double reamer and the Plotts reamer. I have used the Willard reamer, and also the Wilson reamer. I used the Austrian reamer first in 1894 until about 1899. At the present time I am using Double underreamers. I have also had very successful use with the Wilson underreamer.

I used the Willard reamer in 1901 on the Alliance Oil Company's property near the mouth of the Newhall tunnel. Mr. O'Donnell was there part of the time it was being used. The reamer was a 9 $\frac{5}{8}$. That reamer is now in the shop of the Wilson Willard Manufacturing Company of this city. I used it on only the one hole at Newhall.

It is in identically the same condition, as my memory goes. My recollection of its use is not very clear but I remember that we had some trouble due to the sand gathering in behind the sleeve, and we had to wash it out every time we run it. That sleeve was built entirely too close—it fit the reamer body too closely. We had trouble in getting the reamer into the hole at times. We used a string or wire or something and tied the knives together before running it into the casing.

Q. 62. Now, tell us, please, about the use of this

(Testimony of William G. Lehman.)

Willard reamer up there in 1901—what you did with it?

A. Well, I can't remember but very little, only I know we used it with some success; also we had a great deal of trouble, too.

Q. 63. What was the—

A. On account of the sand getting in behind that sleeve.

Q. 64. Well, tell us, please, in obtaining the success you have referred to, how you used the reamer? Take your time and think, if you want to. There is no hurry.

A. In the ordinary way of using the reamer it was inserted in the hole and the knives was collapsed. In getting below the bottom of the pipe they would expand so as to enlarge the hole [331] for the casing.

Q. 65. Well, tell us about this enlarging, if you can, anything further, and what results you got.

A. In running below the pipe the knives would expand so as to drill the hole larger than the casing, allowing the casing to be lowered down.

Q. 66. How far, if you can remember, approximately, did you lower the casing this way?

A. I couldn't tell you. We had some success with it and some results, but how much I can't remember.

Q. 67. Do you remember anything about the kind of formations you encountered in this well?

A. Yes, we had some very hard formations. Some granite, some nigger-head, and some very soft shale.

(Testimony of William G. Lehman.)

Q. 68. On which of these formations did you use this Willard reamer? A. On the hard formation.

Q. 69. Do you remember how deep that well was, approximately?

A. That well was about 840 or 860 feet.

Q. 70. Do you remember whether it produced when you got through with it?

A. No; it didn't.

Q. 71. What can you say with regard to the formations in this well up there in comparison of them with other formations you have met in other parts of California?

A. The formation on top down to 300 feet was very hard. In fact, we had an anvil on the floor and the number of bits we dressed just wore the anvil until there was a hole right through it, we had so many bits to dress—a very hard formation.

We turned the anvil down, and there is a kind of lug on there that just worked itself through the floor. We had to dress—oh, any number of them; three or four a day. But after 300 the [332] formation was soft.

Q. 72. During how much of the drilling of this well, approximately, did you use this Willard reamer? A. But very little.

Q. 73. Well, I mean during what parts, during what stages of the drilling?

A. Why, it was hard, in the hard formation.

Q. 74. Did you use any other reamer on that well?

A. No; we did not.

Q. 75. How far did you get the casing down in that well?

(Testimony of William G. Lehman.)

A. I don't remember. We had three strings of pipe in there—we had $11\frac{5}{8}$, $9\frac{5}{8}$, $7\frac{5}{8}$.

Q. 76. Well, can you remember approximately how far you went with the casing? Very roughly—any way that you can safely put it.

A. We had somewhere about 150 feet of $11\frac{5}{8}$, and there was something over 300 feet of the $9\frac{5}{8}$, and then we had close to the bottom the $7\frac{5}{8}$.

I can fix the date as 1901 that we used that reamer at Newhall as I was married August 8, 1900 and I took my wife up there. I was there until the well was completed and we pulled it out and attempted to lower a larger-sized casing. I pulled everything out and got in a cavey formation. We attempted first to ream the hole without any casing in at all, and it caved so we could not do it, and we worked quite a while without any casing in, and then we got word to abandon the proposition. Never used it at any other time or place. We didn't use it enough to get much of an opinion on it. We didn't test it out very much. It would be impossible to ream some formations with the Austrian. It was not strongly built enough. I don't think that you could accomplish but very little with the Austrian reamer in the formation at Newhall. [333]

Q. 88. Did you at any time ever use any other Wilard underreamer, this is, built like this one?

A. I used one $7\frac{5}{8}$ and one 10-inch. The construction was a little different.

Q. 89. When and where did you use these?

A. I used one in the Los Angeles field on the

(Testimony of William G. Lehman.)

Whittier Consolidated property.

Q. 90. When?

A. I couldn't say the exact year. It was later than '97.

Q. 91. Later than—

A. One thousand eight hundred and ninety-seven.

Q. 92. And what was the size of this reamer?

A. $7\frac{5}{8}$.

Q. 93. And how about this 10 inch?

A. That one I used in the Coalinga field. That would be along in '98 or '99.

Q. 94. Give the year in full please?

A. One thousand eight hundred and ninety-eight or one thousand eight hundred and ninety-nine.

Q. 95. Do you know where that reamer came from?

A. Yes. Mr. Willard delivered it to me on the lease, the Octave Oil Company's property.

Q. 96. Where were you just before you went up to that Coalinga property?

A. I was in the Los Angeles field.

Q. 97. And where were you before that?

A. I was in the Coalinga field before that, too. I was in the Coalinga field in '97.

Q. 98. What year?

A. One thousand eight hundred and ninety-seven.

Q. 99. And where were you after leaving Newhall? [334]

A. I was over at the Western Union Oil Company in the Santa Maria field. That was along during—I have got them dates wrong. I guess. I was in the

(Testimony of William G. Lehman.)

Santa Maria field along about '95 or '96. I was there a year and a half.

Q. 100. My question was where you were after you left Newhall in 1901?

A. In the Los Angeles field.

Q. 101. And after that?

A. I was in the Coalinga field after that.

Q. 102. What years or what year.

A. One thousand eight hundred and ninety-seven.

Q. 103. Well, you have testified you were in Newhall in 1901? A. Yes.

Q. 104. And now you say that after that you were in Coalinga in 1897?

A. No; that is wrong.

Q. 105. Will you please straighten out your dates, if you can remember.

A. I was in the Coalinga field in '97; I know that. And then in 1901 I was in the Newhall field—in '97 and '98 I was back in the Coalinga field.

Q. 106. Give the full numeral numbers of those years, please.

A. One thousand eight hundred and ninety-seven and one thousand eight hundred and ninety-eight.

Q. 107. That is four years before you were up at Newhall?

A. No; I am getting these—I was there before and after both.

Q. 108. Now, when were you there after? Take your time to think. I am not trying to rattle you. I am trying to find where you were and when?

(Testimony of William G. Lehman.)

A. I was in Coalinga field in '06 and '07. [335]

Q. 109. At any time after that?

A. Yes. Oh, there was a number of times. I can't just collect the dates right.

Q. 110. Well, now, let us get it clear. Which of these times, if you can remember, it was that you used this 10-inch reamer there?

A. Somewhere between 1907 and 1909. That was in the Coalinga field. I got the "97's" and "1907's" mixed.

Mr. BLAKESLEE.—(To the Special Examiner.) Just put that on there: "I got the '97's' and '1907's' mixed."

Q. 111. And did you use that 10-inch Willard reamer to any extent up there at that time?

A. I attempted to but the knives were so large I had trouble in entering the pipe and getting it down the hole. At that time I had a long string of 10-inch in and expected to shut the water off soon and I was afraid to take chances on using the reamer.

Q. 112. Did you ever use a Willard reamer after that? A. Yes.

Q. 113. And when and where?

A. I can't recall where it was.

Mr. BLAKESLEE.—You may inquire, Mr. Lyon.
Cross-examination.

(By Mr. LYON.)

Q. 114. When was it? A. How is that?

Q. 115. When was it? You say you can't recall where it was. Now, when was it that you used an-

(Testimony of William G. Lehman.)

other Willard reamer after this attempt to use this 10-inch in Coalinga?

A. I thought he said the Wilson. [336]

Q. 116. Oh, then you understood by your testimony that you were attempting to use the 10-inch reamer at Coalinga, that the question was directed not to the Willard reamer or the O'Donnell and the Willard reamer like the one that you say that you saw at the shop to-day but was addressed to the Wilson reamer? Is that it?

A. No; it was not the same reamer. It was another one. The one we used at Newhall was a 9 $\frac{5}{8}$, and this was a 10-inch at Coalinga. It was not the same reamer at all.

Q. 117. Yes, and then you referred to another Willard reamer, didn't you, and said you didn't recall where it was that you had used it, after using this 10-inch at Coalinga? A. Yes.

Q. 118. Now, when was it that you used that Willard reamer?

A. That was at the Circle Oil Company at Coalinga.

Q. 119. What size was that? A. 10-inch.

Q. 120. This same 10-inch reamer that you have been referring to?

A. No. The one I am referring to now was the Wilson underreamer.

Q. 121. I show you a copy of letters patent of the United States Number 762,458, dated June 14, 1904, and ask you if that is like the reamer that you have referred to as the Willard reamer?

(Testimony of William G. Lehman.)

A. This is like the one that I used on the Whittier Consolidated, the $75/8$.

Q. 122. And when was it that you used that on the Whittier Consolidated?

A. That was in—this is not exactly the same [337] as the one I used, that $75/8$ there. This wedge in the bottom is different.

Q. 123. Any other differences?

A. It had a trip on the side here on that one the same as this, that shoved this wedge down.

Q. 124. The trip that you refer to is referred to as Numbers 28 and 26 on the drawing of the patent which you now have in your hands, is it not?

A. Yes.

Q. 125. Now, approximately, when was it, Mr. Lehman, that you used this reamer on the Whittier Consolidated? A. It was in 1898 or 1899.

Q. 126. Where did you get that reamer?

A. I bought it from Arthur Willard.

Q. 127. And how did that operate?

A. There was some changes. It was not exactly like that one. The wedge is different in the bottom there.

Q. 128. In what respect was the wedge different?

A. Why, it was more in a V-shape than round.

Q. 129. And how did that reamer, the one that you have last been referring to and the one that you bought from Arthur Willard and that you say you used in the Whittier Consolidated, operate, so far as the result secured by its use was concerned? Did you have any difficulty with it in the hole?

(Testimony of William G. Lehman.)

A. Yes; I had some difficulty.

Q. 130. Can you state approximately what the character of the difficulty was?

A. The pin that was attached to that wedge got bent. We had some trouble with it.

Q. 131. And was that trouble in getting the reamer out of the hole? A. Yes. [338]

Q. 132. Who was working on the Whittier Consolidated well at that time with you?

A. I don't know. I don't remember now.

Q. 133. Thomas A. O'Donnell had nothing to do with it, did he?

A. He was not working on that one; no. I was working for him.

Q. 134. Was he out there at any time to see this Willard reamer at work on this Whittier Consolidated property? A. Not this one; no.

Q. 135. He had been out there at the Whittier Consolidated property, then, to see the other Willard or O'Donnell & Willard reamer operate, had he?

A. We didn't use the other one on that lease.

Q. 136. Where was the property of this Whittier Consolidated that you refer to located?

A. It is in the Los Angeles field, on Newhall street and at that time it was Ocean View avenue.

Q. 137. Here in the city of Los Angeles?

A. City of Los Angeles.

Q. 138. Is this Arthur Willard, from whom you bought this reamer which, as you say, was substantially like Patent 762,458, with the exception of the V-shape of the wedge, the same Arthur Willard that

(Testimony of William G. Lehman.)

you refer to as having been with you up at Newhall when you tried this $9\frac{5}{8}$ reamer up there on the Alliance Oil Company well?

A. Yes; the same.

Q. 139. What other trouble did you have with this last style of Willard reamer besides the bending of this trip?

A. That was all the trouble we had.

Q. 140. What did you do with that reamer?

A. It was left on the property of the Whittier [339] Consolidated.

Q. 141. Did you abandon it there?

A. Which? The—

Q. 142. This last Willard reamer that we are speaking about.

A. We finished the well and had no more use for it, and it was left there with the balance of the tools, the last I remember of.

Q. 143. You don't know what became of it, then?

A. No; I do not.

Mr. LYON.—In connection with the testimony of this witness, complainants offer in evidence letters patent of the United States Number 762,458, dated June 14, 1904, as "Complainants' Exhibit Arthur Willard Patent of 1904."

Q. 144. Did you ever try any other of these Willard reamers like this last one we have been referring to at any other time? A. No; I did not.

Q. 145. Do you know what became of this 10-inch Willard reamer which you say you attempted to use at Coalinga?

(Testimony of William G. Lehman.)

A. My recollection was it was taken to Coalinga to the American Petroleum Oil Company.

Q. 146. Was Mr. O'Donnell present when you attempted to use it on the property of the Octave Oil Company? A. He was not.

Q. 147. Did you attempt to run it into the well-hole on the property of the Octave Oil Company more than one time? A. Yes.

Q. 148. How many times?

A. We worked with it there one whole day. We got it down the hole almost to the bottom where we wanted to ream, and then we pulled it out.

Q. 149. You did no underreaming, then, with it?

A. No; we did not. [340]

Q. 150. You don't know where that 10-inch O'Donnell and Willard reamer went to after it was delivered to the American Petroleum Company at Coalinga, do you? A. I do not.

Q. 151. Do you know anything about its subsequent history, or whether it was used at all?

A. No; I do not.

Q. 152. Did that 10-inch reamer differ from the 9⁵/₈-inch reamer that you used or attempted to use out at Newhall? A. Yes.

Q. 153. In what respects?

A. The knives were constructed a little different.

Q. 154. Can you describe in what way they were constructed different? A. They were wider.

Q. 155. In what part were they wider?

A. Wider on the bottom.

Q. 156. Any difference in the upper ends or shanks

(Testimony of William G. Lehman.)
of the knives or bits?

A. There was some difference, but I can't recall what it was in my mind.

Q. 157. Did you use on that 10-inch O'Donnell & Willard reamer the same kind of tripping device that was used on the 9 $\frac{5}{8}$ out at Newhall? A. No.

Q. 158. In what respect was that different?

A. There was no sleeve on it at all.

Q. 159. Well, was there any kind of tripping device on this 10-inch O'Donnell and Willard reamer that you tried at Coalinga? A. There was none.

Q. 160. Who worked with you on this well at Newhall? [341]

A. I had a number of men there. Fred Fish worked there for a while, but he only worked there on the last end of the well.

Q. 161. Do you remember the name of any man who worked there while you had this 9 $\frac{5}{8}$ -inch O'Donnell and Willard reamer there and when you were attempting its use?

A. I can't recall the names of any men.

Q. 162. While you were at this well at Newhall, who operated this 9 $\frac{5}{8}$ -inch O'Donnell and Willard reamer? A. I did.

Q. 163. If I understand correctly, it was brought out there by Mr. Arthur G. Willard? Is that right?

A. It was either brought out or sent out. I don't know whether he brought it or not, but he came along at that time when the reamer was first brought out.

Q. 164. And how long did he remain?

A. He was there for a part of one day.

(Testimony of William G. Lehman.)

Q. 165. Who else was present at that time?

A. The crew that was working on the well. I can't recall the names of them.

Q. 166. Was Mr. O'Donnell there at that time?

A. Not when Willard was there, to my recollection.

Q. 167. When did Mr. O'Donnell come after this 95/8-inch reamer was brought out to that Newhall well?

A. Why, Mr. O'Donnell was out there practically very few times. He made occasional trips out.

Q. 168. When did you first run this O'Donnell and Willard 95/8 into that Newhall well-hole? Immediately after its arrival? A. Soon afterward.

Q. 169. The same day?

A. I think so. We run it the day he was there—Mr. Willard was there. [342]

Q. 170. How much did you run it that day?

A. I couldn't say exactly. I rather think we attempted to use it before he came out.

Q. 171. You say, "We attempted to use it." Who do you mean? A. Myself and helper.

Q. 172. Mr. O'Donnell was not present at that time? A. Not at that time; no.

Q. 173. And when did Mr. O'Donnell first see that 95/8 at Newhall?

A. Why, he was there sometimes after it arrived. I don't know just the time.

Q. 174. He was not there while Arthur Willard was there, then? A. Not to my recollection.

Q. 175. Did Mr. O'Donnell himself run that 95/8

(Testimony of William G. Lehman.)

reamer into the Alliance well-hole and superintend its running for several days.

A. He was there when we was running it. How long he was there I can't remember.

The Plotts underreamer I used was on the O'Donnell Oil Company property. We used it several times. It was a $7\frac{5}{8}$ and a $9\frac{5}{8}$. I used a $7\frac{5}{8}$ and a $9\frac{5}{8}$.

We used it with the drilling bit below it. We used a very short stub bit, in the neighborhood of four feet long. We used the bit in front of the Plotts' reamer because we thought it was necessary, to act as a guide. That is also the way we used the Austrian reamer. [343]

I think the first Double underreamer I used was on the Western Union Oil Company property at Santa Maria. That was along in 1905 or 1906.

We dressed the bits or cutters of the $9\frac{5}{8}$ O'Donnell & Willard underreamer while using it at Newhall. Dressed them several times. The reason we stopped the $9\frac{5}{8}$ casing where we did in the Newhall well at the time of running the O'Donnell & Willard reamer was that we got a showing of oil at that place and did not desire to carry the $9\frac{5}{8}$ casing any farther. We could have carried it farther with the O'Donnell reamer if we had desired to.

Q. 221. You are acquainted with Mr. B. W. Youngken, who is now here in the room, are you not?

A. I am.

Q. 222. And you have met Mr. Thomas J. Griffin?

A. I have.

(Testimony of William G. Lehman.)

Q. 223. You had some conversation with both of these gentlemen on about November 17, 1912, on the property of the Bellridge Oil Company in Kern County, California, respecting this O'Donnell and Willard reamer, did you not? A. I did.

Q. 224. And subsequently to that, and on or about the 30th day of November, 1912, or December 1, 1912, you had a conversation with Mr. Youngken in the presence of Mr. E. H. Williams, the superintendent of the Union Tool Company's shop at Taft, at this Bellridge property, in Kern County, in regard to this same underreamer, did you not? A. I did.

Q. 225. Was there any person present during that conversation?

A. Why, Mr. Johnston was present at that time.

Q. 226. What Mr. Johnston?

A. Mr. W. H. Johnston.

Q. 227. Who is Mr. W. H. Johnston? [344]

A. He is a driller in my employ.

Q. 228. How long has he been in your employ?

A. On the Bellridge property about six months.

Q. 229. How long have you known him?

A. I have known him for eighteen or twenty years.

Q. 230. Do you know him well enough to know whether he is a reliable man and generally states the truth? A. Yes, sir.

Q. 231. Does he? A. He does.

Q. 232. How did Mr. Johnston come to take part in that conversation that day?

A. I invited him to meet Mr. Youngken.

Q. 233. For what purpose?

(Testimony of William G. Lehman.)

A. To talk over this underreamer.

Q. 234. What does Mr. Johnston know about it?

A. In this conversation at that time he did not know much about it, only hearsay.

Q. 235. What did he say at that time?

A. We was trying to fix a date that reamer was used in the Whittier field. He said he knew of it being used there although he hadn't used it himself.

Q. 236. And he stated at that time, did he not, that the reamer was stuck in the hole and they spent two or three days, as he remembered, jarring it loose, and that if he had his diary or record book with him, which he had in Los Angeles, he could tell exactly how long it took to get it out. Is not that the conversation in that regard?

A. That is what he said.

Mr. BLAKESLEE.—We object to all this line of examination as to what this man Johnston had to say, as it was a conversation not in the presence of the parties to this suit, and if defendant wishes [345] to take the testimony of this man Johnston, let him appear at the proper time and testify, and then we will deal with his case as may seem proper after hearing his story.

Q. 237. (By Mr. LYON.) And it is a fact, is it not, that you told Mr. Youngken, in the presence of Mr. Williams, that Mr. Johnston could probably tell him all about it as he, Johnston, was the first one to run the reamer?

A. Now, those words are not right, I didn't say he was the first one to run the reamer.

(Testimony of William G. Lehman.)

Q. 238. What did you say?

A. I said he knew about as much about it as I did. I thought at that time he had used it himself on the Fidelity.

Q. 239. And in a subsequent conversation that ensued you found that it was the Elmora?

A. Yes. And, further, he never worked on the Elmora at all. It was a lapse of memory, he told me afterwards.

Mr. LYON.—We move to strike from the record and exclude from consideration all the part of the answer of the witness including and following the words, “And further,” on the the ground that it is not responsive to the question, and hearsay, the purpose of the present interrogation as to this conversation being for the purpose of impeachment of this witness and not with relation solely to what was actually done with the O'Donnell and Willard reamer.

Q. 240. Did you not state in this conversation that you first used this reamer on the Whittier Consolidated lease? A. Which reamer?

Q. 241. The O'Donnell and Willard reamer.

A. I said I had used one there on the Whittier Consolidated. Not the first time.

Q. 242. Did you not in that conversation state that you didn't remember whether there were any changes whatever made on [346] the reamer before it was sent to Newhall?

A. There was nothing said about that that I remember.

Q. 243. You state positively that you didn't say to Mr. Youngken, in the presence of Mr. Williams,

(Testimony of William G. Lehman.)

that you did not remember whether there were any changes made in this O'Donnell and Willard reamer before it was sent to Newhall?

A. Mr. Williams didn't hear all the conversation.

Q. 244. Will you state positively that you didn't make the statement last referred to to Mr. Youngken at the time referred to?

A. I don't remember doing so.

Q. 245. Will you state that you did not say it?

A. I did not say it.

Q. 246. And is it not also true that in this conversation to which we have last referred you stated that you thought Mr. Willard was at the Newhall well, but you were not positive of it? A. Yes.

Q. 247. Now, since coming to Los Angeles you have had a talk with Mr. Willard in regard to this matter, have you not? A. To a certain extent; yes.

Q. 248. And have discussed his being at the well at Newhall with him?

A. That was possibly mentioned in the conversation.

Q. 249. Well, it was mentioned, wasn't it?

A. Yes.

Q. 250. And he, Mr. A. G. Willard, told you that he was there, did he not?

Mr. BLAKESLEE.—Objected to, on the ground that any statement made to the witness by anybody else must come to us directly on the record, not indirectly through this witness.

Q. 251. (By Mr. LYON.) Read the question to the witness.

(Testimony of William G. Lehman.)

(Question No. 250 read to the witness by the Special Examiner.) [347]

A. He did.

Q. 252. Did you discuss with Mr. A. G. Willard whether Mr. O'Donnell, and I mean Thomas A. O'Donnell, was at the well at Newhall while Mr. A. G. Willard was there? A. We did not discuss it.

Q. 253. You had some conversation to-day, in this office, in which you and Tom O'Donnell took part, and which was a discussion of this O'Donnell and Willard reamer and this Newhall use of it, did you not? A. We did.

The reason that after running this 10-inch O'Donnell & Willard reamer into the well hole on the Octave property at Coalinga I withdrew it from the casing without underreaming was I had a long string of pipe in there and I was getting ready to shut off the water, and I didn't want to take chances on getting a tool stuck in the hole, because we had to move the casing every few minutes to keep it from freezing up.

Redirect Examination.

(By Mr. BLAKESLEE.)

Q. 262. This Willard reamer you have testified about as using up at the Consolidated property at Whittier and having a wedge in it, which, as I remember, you said you moved up and down, was used before or after you used the O'Donnell and Willard reamer up at Newhall?

A. This Whittier Consolidated property was here in the Los Angeles field; not at Whittier. We drove

(Testimony of William G. Lehman.)

a well at Whittier, the Whittier Consolidated, and then we took some other property in here.

Q. 263. (By Mr. LYON.) But you didn't use the Willard reamer at Whittier, California? [348]

A. No; no.

Q. 264. (By Mr. BLAKESLEE.) Now, when was this used? Before or after you were at Newhall?

A. In my testimony before I made some mistakes in the dates. I testified that I used that on the Whittier Consolidated in 1900 and 1898 or '9; and I used that one after I used that at Newhall.

Q. 265. Now, can you remember what year it was?

A. It was somewhere between 1902 and '4 somewhere.

Q. 266. When Mr. Youngken came to you, about the 1st of December, as I remember it, up at McKittrick,—McKittrick, wasn't it? A. Bellridge.

Q. 267. Up at Bellridge, at the Bellridge property, how was the conversation opened up with him?

A. Why, they asked me if I remembered the circumstance of using that underreamer in the Newhall field. I was not sure in my mind—had practically forgotten it—and he asked me to try to refresh my memory, when he come along again, and let him know; also asked me if Mr. Willard was there when I ran the reamer, and I told him I was not sure, but I thought he did, that he was there at the time.

Q. 268. And how long had it been before since you had thought over these Newhall happenings?

A. I had not thought of it for years.

Q. 269. And after Mr. Youngken came up and

(Testimony of William G. Lehman.)

kindly suggested that you refresh your memory, did you think them over and refresh your memory?

A. I did.

Recross-examination.

(By Mr. LYON.)

Q. 272. Mr. Lehman, Mr. Youngken was out to see you at the [349] Bellridge property once with Mr. Thomas J. Griffin, was he not? A. He was.

Q. 273. And then he came later and interviewed you a second time, and had in his company at that time Mr. Williams? A. He did.

Q. 274. Now, was it not at this first interview that this suggestion was made that you refresh your recollection? A. It was made at both interviews.

Q. 275. And was not the suggestion first made by Mr. Thomas J. Griffin? A. It was.

Q. 276. And Mr. Youngken came back the second time to see you to see what further you had been able to recall in regard to it? A. He did.

Mr. LYON.—That is all.

Testimony of Arthur G. Willard, for Defendant.

I am acquainted with William Grant Lehman who has testified in this case two days ago. He was at the shop of the Wilson & Willard Mfg. Co. at Los Angeles. He was there to inspect the underreamer in evidence as "Defendant's Exhibit O'Donnell & Willard Underreamer." I called Mr. Lehman's attention to that reamer. I told him, "There is the old O'Donnell & Willard reamer that you run up in the tunnel." And he immediately recognized it by the slidable collar at the top of the reamer, and stated

(Testimony of Arthur G. Willard.)

that that is where he had the trouble with it. Complainants' Exhibit "A," Willard U. S. Patent No. 762,458 was granted to me. I commenced experimenting with an underreamer like that described in this exhibit in April, 1903. I made a wooden model and applied for a patent, then entered an order with the Baker Iron Works for the manufacture of 5 $\frac{5}{8}$, afterwards a 7 $\frac{5}{8}$, and later on a 10". They were all completed. William Grant Lehman [350] used one of these reamers. Charlie Alexander paid the expense of making these three reamers and the expense of securing the patent for one-half interest in the invention. I wrote Mr. Lehman a letter to Bakersfield, which he finally received at the Bellridge Oil Company, and in his answer he stated he did not remember using the O'Donnell & Willard underreamer at the Newhall Tunnel, but he did remember using this 7 $\frac{5}{8}$ underreamer with the wedge action, and I took Mr. Lehman to the shop for the purpose of identifying the O'Donnell & Willard underreamer, as I testified that he had run this underreamer at the Newhall Tunnel. Mr. Lehman came down to the Wilson & Willard Manufacturing Company's shop and I took him out and showed him Defendant's Exhibit O'Donnell & Willard Underreamer. I talked with him regarding its use at Newhall and in regard to how it worked. I also talked with him in regard to the 10-inch O'Donnell & Willard reamer that was built in 1908 at the Wilson & Willard Mfg. Co.'s shop. Prior to the time that Tom O'Donnell testified in this case I talked with

(Testimony of E. C. Wilson.)

him in regard to the alleged use of the O'Donnell & Willard underreamer at Newhall and also in regard to the 10-inch O'Donnell & Willard reamer.

I have talked with Mr. Thos. O'Donnell relative to the advisability of bringing a suit on the O'Donnell & Willard patent. I called Mr. Blakeslee's attention to that possibility, that the Double reamer was infringing the O'Donnell & Willard patent.

**Testimony of E. C. Wilson, for Defendant
(Recalled).**

While I was working for the Baker Iron Works of this city I made up the charge number 3856 appearing on the books of the Baker Iron Works, which is a charge covering the manufacture of one of the O'Donnell & Willard reamers. I also made up the charge, namely, entered the cost cards and material cards against the order, aggregated the amount of time and material, and total to charge.
[351]

Cross-examination (E. C. WILSON).

I have been interested in the underreamer business for the past nine or ten years. I am acquainted with the efforts of various companies to manufacture an underreamer which would be successful and which would not infringe the patents now in existence. For instance the Oil Well Supply Company has made an exhaustive research of the state of the underreamer art and have a report on same. I saw that report and according to it they were narrowed down to a pretty small field of invention in order to make an underreamer which would be successful and avoid

(Testimony of E. C. Wilson.)

the patents now in existence. The Wilson underreamer patent particularly was mentioned as one which would be an obstacle which would be difficult for them to surmount. The Double underreamer patent was also mentioned and also the O'Donnell & Willard patent, was also considered reamer patents which would be difficult for them to circumvent.

We, the Wilson & Willard Manufacturing Company, sell our Wilson underreamers to the Oil Well Supply Co. The reamers which they had made up after their own design, and I believe were not even tried out.

In regard to the comparative selling facilities of the Union Tool Company, and our company will say that the Union Tool Company have a very extensive selling organization. Furthermore, special discounts they have allowed the California National Supply Company, the J. F. Lucey Oil Well Supply Company, The Union Well Supply Company, and two or three other houses doing general Oil Well Tool and Supply business has been the reason for those firms selling Double underreamers in preference to the Wilson reamer. Naturally their sales of the Union Tool Company reamers or Double reamers are very much in excess of those of the Wilson underreamer. At the time I first commenced selling Wilson underreamers, the Oil Well Supply Companies, namely, the different firms such as the California National Supply Company, Fairbanks- [352] Morse & Co., The J. F. Lucey Company, and others were receiving a discount of 10% on the Double

(Testimony of E. C. Wilson.)

reamers and were selling them at list. I allowed them the same discount and did not for a long time ascertain that secretly Double was allowing them a discount of 15% off the list. This is a special discount to which I refer and which was the occasion for their selling Double underreamers in preference to the Wilson reamers. It was not until 1909 or 1910 that I changed my discount from 10% to 15% to the supply houses.

I have always used the same price list that Mr. Double has used, selling my reamers to the consumer at the same price he established. Hence I say the discount of 15% to the supply houses which Double was allowing, was .05% better than I was allowing them. Therefore, from the years 1905 until probably 1909 or '10, it was naturally to their interest to sell Double reamers in preference to Wilson reamers.

Concerning the special discount, will say that the practice of the Union Tool Company in giving special discounts to the supply houses was so general that each supply house seems to feel that the other fellow is getting some special discount or some special privilege that he himself is not enjoying. I have heard one or two houses complain that they believed they were not getting a fair deal from Double in the way of discounts. That they believed other houses were getting a better discount than they.

Testimony of A. G. Willard, for Defendant.

The 7 $\frac{5}{8}$ " Willard & O'Donnell underreamer used successfully by Mr. Thomas O'Donnell did not have the locking device on it as set forth in the O'Donnell & Willard patent. We did not think it was necessary. We never used it. [353]

STIPULATION.

By Mr. LYON.—It is stipulated and agreed, in view of the testimony of A. G. Willard, that the William G. Lehman, in his testimony given in this case Saturday night, December 21, 1912, in referring to a 9 $\frac{5}{8}$ " O'Donnell & Willard underreamer as seen by him in the shop of the Wilson & Willard Manufacturing Company that they in company with A. G. Willard, referred to the underreamer heretofore offered in evidence by defendant as the "Defendant's Exhibit O'Donnell & Willard."

**Testimony of W. W. Wilson, for Defendant
(Recalled).**

By Mr. BLAKESLEE.—The small brass model referred to is offered in evidence as "Defendant's Exhibit Small Brass Model of Wilson Patented Underreamer."

The brass model of the Wilson underreamer was manufactured by the Wilson & Willard Manufacturing Company and was made as nearly as possible to conform in design and construction to the drawings shown in the patent of the Wilson underreamer.

Further in regard to the brass model of the Double underreamer will say that it was made to conform

(Testimony of W. W. Wilson.)

as nearly as possible to the Double underreamer patent. Since that model was made, however, I have noted a few differences between this model and the patent drawings, namely, the lower set of dovetails on the cutters at present in this model which are not present in the patent "Complainants' Exhibit Double Underreamer Patent."

By Mr. BLAKESLEE.—We offer in evidence the small brass model last referred to, as "Defendant's Exhibit Small Brass Model of Double's Patented [354] Underreamer" (with lower dovetails added).

By Mr. LYON.—It is stipulated that the photograph last referred to by the witness is a photograph taken in July, 1909, at a well being drilled in Whittier field by Allen Craig, the equipment having been furnished by the Union Tool Company, and containing the calf-wheel arrangement the subject of the Craig and Double patent, differing from the earlier calf wheels in instrumentalities which were immaterial in this case. The photograph was taken of a drilling rig in which the bull rope was a manila line and the casing line and drilling line a wire rope or cable. The pipe or casing shown in the photograph in the well operating was a 11 $\frac{5}{8}$ " casing, and had been lowered to a depth of about 1800 feet at that time the photograph was taken. And it is stipulated that the manila rope lying in a coil underneath the driven portion of the calf wheel is an extra bull rope. The photograph shows the bull rope on the bull wheel, and the drilling line extending up on the drum of the bull wheel to the top of the derrick, and is by this

(Testimony of W. W. Wilson.)

means that the bit shown in the photograph as protruding into the well casing is suspended. And this photograph was produced by counsel for complainants at the request of defendant, and shows a Union reamer in the derrick.

By Mr. BLAKESLEE.—The photograph last referred to is offered in evidence as “Defendant’s Exhibit Photograph of California Oil Well Rig, Showing Calf Wheel, Bull Wheel, Wire Rope and Top of Casing in Hole, the Casing Shown Being Heavy Casing Weighing not Less Than 54 Lbs. to the Foot.”

Q. 500. What can you say further with respect to these reamer parts?

Mr. LYON.—Of your own knowledge.

A. This is the lower half of a Double underreamer body. [355] A part of the cutter-shank of one of the cutters is shown within the body, the lower end of the dovetail portions of the body being bent inwardly as though striking down on some hard substance, the lower portion of the hollow-slotted extension having been worn and refaced with plates to take up the wear at this point, these plates having been set into recesses machined in the lower end of the partition for their reception. The upper portion of the other cutter is shown herein; however, the small burr on the corner of the dovetail portion of the body was broken off by myself and the foreman of the Wilson & Willard Manufacturing Company in getting the part of the cutter out of the body.

This body was obtained in a scrap heap on the Salt Lake oil fields property, an addition to the city of

(Testimony of W. W. Wilson.)

Los Angeles. This is a broken part of what remains of a Double improved underreamer. I obtained this broken body and broken cutters about a month ago. I have no personal knowledge as to any use of these parts or how they came to be in this condition.

(The reamer parts just discussed by witness are offered in evidence as "Defendant's Exhibit Parts of Broken Improved Underreamer.")

**Testimony of Arthur G. Willard, Recalled, at the
Request of Counsel for Complainants.**

I was present at the lease of the Central Oil Company while they were attempting to remove the 7 $\frac{5}{8}$ " Willard underreamer which had been stuck in the casing, but not an O'Donnell & Willard underreamer. The reamer which was stuck in the casing was substantially like that shown in "Complainant's Exhibit A. Willard U. S. Patent #762,458."

I cannot say that it was the Alliance Oil Well where the O'Donnell & Willard reamer was used near Newhall. I know that [356] William Lehman was the driller in charge and that he was working for Tom O'Donnell. Mr. O'Donnell was not there while I was there. I did not meet Fred Fish there that I know of. The only man I remember is Lehman.

The bar which I have here was the Tee-Bar for Wilson underreamer. A Tee-bar similar to that was used in the Wilson underreamer some time prior to the year 1907. It has also been used between the year 1908 and '10. This bar is used in connection with a block in the reamer body which is held in place

(Testimony of Arthur G. Willard.)

with set-screws. The purpose of the block is to hold the spring in place in the body.

The Tee-bar differs in form from the present construction in that the present Tee-bar used in the Wilson reamer is slotted as in the "Complainant's Exhibit Wilson Underreamer, #2."

By Mr. LYON.—The Tee-bar referred to by the witness offered in evidence as "Complainant's Exhibit Wilson Spring-Actuated Rod and Retaining Block." The slotted Tee-bar is more convenient for the operator in assembling the Wilson underreamer. [357]

Testimony of H. G. Bailey, Witness on Behalf of Complainant.

Mr. Bailey deposes and testifies as follows:

My name is H. G. Bailey; residence, Whittier; occupation, oil driller; age, 32. Have worked on the Whittier crude oil property and the Almore properties in Whittier. The Elmore Oil Company operated on my grandfather's property.

I was employed on the Elmore lease as a tool dresser in about 1901. I met Tom O'Donnell at the Elmore well. They brought an underreamer out there to try, Mr. O'Donnell, I don't know who was with him; I think it was Dick Harris, though, manager of the oil company. They tried to run that reamer. We got the reamer down to the bottom of the hole and throwed a rope and tried to find the bottom of the casing, and the reamer stuck in the bottom of the casing; tried that several times and knocked

(Testimony of H. G. Bailey.)

it loose, and it would stick in the shoe every time you pull up against it. Mr. O'Donnell said, "Pull it out; won't run it; it will have to be fixed." We got it out of the hole. About a day getting it out of the hole. We loaded it on to a cart and brought it down to the Whittier Crude lease and left it there. I don't know what became of it. It took about a day to get it out of the El Moro well hole. It would stick at every joint of the casing, almost every joint; especially those joints that was not screwed together tight, the cutters would stick; have to hitch on and jar it up through there. This reamer was not actually used to underream at the El Moro well. It was never returned to the El Moro property after it was carted down to the Whittier Crude lease. I know it was carted down to the Whittier Crude lease. There was a heavy rain come up the day we was running the reamer, and washed out the road. The other tool dresser and myself put the reamer on a cart and pulled it down by hand, down to the Whittier Crude lease; it would be about a mile. They wanted it pulled down there so they could load it into a wagon. [358] Have never seen that reamer since until to-day. No one pointed it out to me. I knew it. (Witness identifies Defendant's Exhibit O'Donnell & Willard Underreamer). The reason I have such a clear recollection of this happening is that the land belonged to my grandfather, and he wanted me to go up there and kind of look after the well, and see that everything was all right; that was one reason I

(Testimony of H. G. Bailey.)

was up there as tool dresser on that well.

I have been drilling oil wells about three years. Was tool dresser prior to that time.

I never saw a reamer like the Canadian 4½" reamer here on the floor marked "Defendant's Exhibit Oil Well Supply Company of Canada 4½" underreamer. I would not run it in that shape. It would break the cutters off on a hard shell. (Witness is shown "Defendant's Exhibit Sample of Swan Reamer" and asked if he ever saw a device like it before). I don't remember that reamer.

Q. 65. Please look again at "Defendant's Exhibit Swan Underreamer" and see if you find any such dovetails as that on that exhibit.

Mr. LYON.—The question is objected to as not cross-examination, and as incompetent, the witness having testified that he does not remember ever having before seen a reamer like the one referred to.

A. There is something similar.

Q. 66. (By Mr. BLAKESLEE.) And they keep the cutters from escaping sideways, don't they?

A. Yes; could not escape sideways without they break the pin; come clear down and fall out. (Witness in last portion of his answer refers to Double underreamer.)

Q. 67. And those dovetails in the Swan exhibit confine the cutters to their movements lengthwise of the body at the bottom, don't they? [359]

Mr. LYON.—All questions relating to this Swan reamer are objected to upon the same grounds stated

(Testimony of H. G. Bailey.)

in the objection to the first question on cross-examination referring to the Swan reamer, and it will be understood that such objection need not be repeated.

A. Yes, sir.

Q. 68. (By Mr. BLAKESLEE.) In the bottom of this Swan underreamer body there is a longitudinal slot, is there not? A. Yes, sir.

The Canadian underreamer would have to have dovetails like the Swan or the Double, in order to hold the cutters in it.

I have known Double underreamers sticking in the casing. We generally tie the cutters with a string. Most any reamer of that type does stick if the cutters are not tied down. I don't remember how long we had the Double underreamer or the O'Donnell & Willard underreamer in the hole. It would stick against the shoe when we attempted to draw it into the casing. I don't remember about it whether it was dropped on the shell or not. I don't know whether it was on a shell or not. We did not try to ream with it at all, we did not hitch it on to the [360] beam. I was not there all the time it was in the hole. Probably two minutes at a time I would be at the boiler sixty feet away.

At present I am working for the Canadian Pacific and they are using Double underreamers. I have never used a Wilson underreamer.

Testimony of S. S. Frampton, Called on Behalf of Complainant.

Mr. Frampton testifies as follows:

I am 49 years old; occupation driller, residence

(Testimony of S. S. Frampton.)

Whittier, California. Have been in the drilling business over twelve years. I am familiar with underreamers and have used the Plotts underreamer, the Double underreamer, the Wilson underreamer and I have tried to use the North reamer and also the Leidecker underreamer.

I tried to use the Leidecker underreamer in the Whittier Field the first time in about 1903. We had trouble to get it down into the hole and consequently did not run it any more. It seemed as though the cutters did not move, and the reamer worked up and down on the cutters. In trying to get the reamer out of the well hole it stuck, and we had to jar it, it would stick in the casing. Have to jar it loose; jar it up; keep pulling it and jarring it, to get it out. I presume we worked at it three or four hours. After we got it out we throwed it on the ground and give it a good cussing. It was not practical to run it. "Defendant's Exhibit Sample of Swan Reamer" is like the one we used.

At about the same time we tried to use the North underreamer but found it would not stand up to hard reaming. The reaming we had to do was very hard—unusually hard. We used it one or two days and practically spoiled it, the bottom of it. We horsed it out the same as we did the Leidecker. We had to jar [361] it and jerk it to pull it out.

The next reamer we tried was the Double. We had a very hard shell, and we was using the Plotts underreamer, and had been working for a week with it up there trying to ream, and we could not seem to

(Testimony of S. S. Frampton.)

make much headway with the reamer. Got a Double and it done the reaming, and we kept the reamer. Have used the Double reamer more or less ever since. Have never broken off a Double reamer cutter. Have used them a great deal, more than any other, I believe.

I have used the Wilson reamer in the Whittier field and also in Ventura county. We had fairly good success with it. Spoiled the reamer; we wore the reamer out; it did not seem to stand the hard usage. We did not finish the well with the Wilson reamer. Finished it with a Double reamer. Did not have any trouble with the Double reamer. Have had the bottom bolts of Wilson reamers bend, trying to get the reamers into the casing. We had trouble with the bolt (bottom bolt) coming out. Never lost any Wilson cutters. Never lost cutters of any kind.

After running a $7\frac{5}{8}$ " Wilson underreamer, reaming about 400 feet with it, we sent it to the shop to be re-machined. Cut back or fixed up. We lost some of the safety bolts of the Wilson underreamer and the bottom of the reamer would then spread.

I have worked for the Central Oil Company,—about four years ago. They used the Double and the Wilson reamers.

When I first came to California we used the Plotts underreamer. It was the only practical reamer at that time, and we had nothing else to ream with except that, and we used that. We had fairly good success with it. It was slow, but we got our reaming

(Testimony of S. S. Frampton.)

done with it. We run very easy; just as easy as we possibly could run on it.

I was on the El Moro property when O'Donnell brought that reamer out to be tried. He came to our well at one time and asked if we wanted to try it. We did not care about trying an underreamer [362], which other people had had trouble with as they had on the El Moro. We would not try it. At that time we were contracting for the Whittier Crude Oil Company. The O'Donnell reamer was brought down from the El Moro and throwed off on our lease. It was not brought to us. Defendant's Exhibit O'Donnell & Willard reamer'' looks like it. I refused to attempt to use it, because of what I had heard in regard to its use at El Moro.

I would not run an underreamer like the Canadian underreamer as I would consider it dangerous to run into a hard shell, you would break the cutters off or have trouble with it. It is not a practical tool to run, if the cutters are made in that manner, in hard formations that we have to work in California. I would tell them to get somebody else to run it. We have used the Plotts underreamer without using the bits with it, that is without having the bits connected to it. The Plotts reamer may be used in the Whittier field yet, I do not know. The Plotts reamer would do the work if you would give it time enough.

The body of the Wilson reamer would not last as long as the body of the Double, because the cutters come loose, and the bottom bolt coming out of the bottom, giving trouble where the Double did not.

(Testimony of S. S. Frampton.)

The Wilson underreamers which are re-machined work just the same as a new Wilson reamer.

I have never had the dovetails of a Double reamer break. They wear of course. I have never had any trouble with jumping the pin at the joint with the body of the Double reamer.

The Canadian underreamer differs from the Double in a number of ways, the cutters being made different and they are held in a different way. The spreading part would be practically the same. [363]

But there is nothing to retain your cutters or to strengthen the cutters from bending and giving you trouble in getting them out of the hole. This could not be remedied by shortening the cutter in this Canadian reamer. You would have the same trouble. In running on anything hard you would bend the cutters. The bending could be prevented to a certain extent if you put on dovetails, but you would have trouble then with the end of your cutters, the block the hole is in would jam back against there; you would eventually break that off, I would judge, or damage it in such a way that it would not work, with hard usage.

The dovetails in the Swan underreamer and the Double are the same. In drilling one must keep the tools on a tight line. You cannot run them on a slack line.

I prefer the Double underreamer having the wide cutters to the old style Double which had the narrow cutters. The wider cutters of a Double reamer hold

(Testimony of S. S. Frampton.)

better than the old cutters used to.

I have not seen any Double underreamers with narrow cutters lately. No. I never saw a Wilson underreamer with cutters as narrow as the old style Double. No, I don't think I ever saw broad cutters of the Double underreamer until after the Wilson reamer came out.

I do not think the Day underreamer would be a practical underreamer.

We didn't use the Plotts reamer any more after we got the Double. I have run the Double harder than I have the Wilson for the simple reason that when I ran the Wilson reamer so hard I lost the bottom pin out, the bolt in the bottom. I have tied the cutters or bits of both the Double and Wilson reamers. Sometimes the bits get wore and they won't go down the casing and catch in the joints and give trouble and stick, and by tying them they go down and won't stick. This wear is on the spreading [364] surfaces and on the sides of the bits, the shanks of the bits. This first Double reamer I used was like "Defendant's Exhibit Double Underreamer." When we first got this Double reamer we had two Plotts reamers, they were comparatively new and in good running order. We never used them after we got the Double. The term "finding the bottom of the casing" in well drilling parlance means you have to find the bottom of your casing to tell where to hitch on to start your reamer when you start to reaming. You practically have got to know where your casing is to know where you want to

(Testimony of S. S. Frampton.)

ream. So you find the bottom of your casing before you hitch the reamer on to the walking beam. To find the bottom of the casing, we throw on the rope and run the reamer down and back to try to find where the reamer enters the casing. Sometimes we can't tell exactly, and we hitch on where we think the bottom is, and invariably the jar of the reamer coming in will tell us where it is. We pull the reamer back into the casing until the bits strike the casing for collapsing. I don't know as there is very much advantage with the broader cutters, in the Double improved reamers. There would naturally be a little less danger of keyseating. I never saw a Wilson cutters broken at the shank. (Shown "Defendant's Exhibit Small Working Model of Day Device.") There are several reasons why I don't think that would be practical. The fact is, I can't see how that could be made to work at all with safety. With the Swan reamer, if the reamer was dropped through and on to the shell and the end of the reamer struck portions of the shell you would spoil your reamer. You would spoil those dovetails. You would drive them in till your cutters wouldn't pull down. Such an injury is not possible with either the Double or the Wilson reamers. I do not know of any company, except the company with which Mr. Plotts himself is personally connected and one of the [365] managing officers of that is using the Plotts reamer.

In reaming you are liable to strike the corners of the bits as well as any other part of it. This would

throw the full force of the blow on the corner. It would throw it in a twist or sidewise movement.

**Testimony of Claude Crawford, Witness Called in
Behalf of Complainants.**

Testifies as follows:

My residence is Whittier, California, I am connected with the oil business. Have been in the oil business about 13 or 14 years. I am a driller for the Central Oil Company. The Central Oil Company is using Double and Wilson reamers. It has been a little over a year since we used the last Wilson. I broke the mandrel of a 10-inch Wilson when jarring the cutters into the shoe. The part of the mandrel that broke was something similar to that marked "Complainant's Exhibit Broken Wilson Reamer Mandrel or T-Rod" the way it is broken there. I lost one cutter in the hole, drilled it up, succeeded in fishing out the other cutter. The Double reamer will stand more grief than the Wilson. I cannot tell you exactly why. I think that extra offset on it, for one thing, is about all.

I think the Double underreamer will stand more work than the Wilson reamer. The reason is on account of the extra offset on it. That is about all.

(Complainants offer in evidence the mandrel referred to by witness and ask that same be marked "Complainant's Exhibit Broken Wilson Reamer Mandrel or Tee-rod.")

I have had experience with steel as a blacksmith and know that when steel is overheated it is burned. It makes it more brittle after having been burned. I

(Testimony of Claude Crawford.)

would not state [366] whether the metal in the broken mandrel was overheated or not. I do not remember the year the mandrel was broken. -Do not remember how long we had used it. Don't remember where we procured that Tee. No, sir. That is the only breakage to Wilson underreamer I ever had. I have had broken Double underreamer cutters break while in use. They broke in the offset. We broke three sets of Double cutters inside of a month. I think the Double underreamer stands up better than the Wilson reamer but I guess my reason for thinking so is a matter of personal prejudice.

I have seen Plotts reamers used on the Murply Oil Company's property. I have never used any narrow cutters of Double reamers. The Double underreamers I have always used is the type having the wide cutters like the Wilson. I prefer the broad cutters. The broad cutters have more cutting surface. The drillers on the Central Oil Company's property have nothing to do with taking care of the tools after they get through drilling with them.

Testimony of T. M. Frampton, for Complainants.

Mr. Frampton testifies as follows:

I am a driller, been engaged in oil well drilling in California for 15 years. I am acquainted with the man by the name of North. I used one of his reamers, or tried it. It was in 1901 or 1902. It was 55/8". We were drilling a well for Mr. Off in the Whittier Field. It was an old well that they had tried to drill

(Testimony of T. M. Frampton.)

and got it plugged up. We were using a Plotts underreamer at that time. At the suggestion of Charles Off, we tried a North underreamer for two or three days. "We didn't have no success with it, and practically wore the thing out—that was about the size of it." North sent a bill for \$60 for rental. I had made no arrangements with him, the arrangements [367] were made with Mr. Off. He sent me another bill and I paid no more attention to it and I recollect right that ended the thing. And I never paid him anything for the rental. I now remember that Mr. North sent out a reamer and sent out instructions how to use it.

He called me up after I got running the reamer and gave me instructions how to run the reamer. If I recollect right he said the reamer should be run in the second hole at thirty strokes a minute.

The next well we drilled on we adopted the Double reamer. It was the first one I ever saw. It was not the style we use to-day. It worked very successfully. The Plotts reamer is a very slow reaming reamer and its a reamer that won't stand any grief, and I found the Double reamer done the kind of work we wanted to do with the reamer—we could get some satisfaction out of it, and in all my work after I first used the first reamer I used nothing else but the Double reamer after that—that is for my own use when I was contracting. Prior to the time I got the first Double reamer there was a demand for a successful reamer.

I have used Wilson reamers. The Central Oil Company use about half Double's and half Wilson's. The Wilson reamer cannot stand up to hard reaming

(Testimony of T. M. Frampton.)

like the Double reamer can. They won't "stand the racket." We run the Double reamers right along the same as we drill and you can't do that with the Wilson.

There is nothing to support the Wilson cutters. We most always tie the cutters of the Double underreamer and the Wilson underreamer together. We do that because they go down the hole so much nicer anyhow. But after you wear cutters a certain length of time they get so that you have to tie them. That is occasioned more from the back becoming worn. By backs I mean the portion which strikes the casing when the reamer is in the casing. [368] The only experience I ever had with the Swan reamer was, I ran one into a hole and could not get it out. I worked practically my whole tower trying to get it out. A tower is twelve hours. My brother got it out but I could not do it. I have seen other men run Swan underreamers though. They had about the same success I had with it.

I have used Wilson underreamers that have been machined back.

The question of preference between the original or old-style Double and the Double improved with wider cutters, is a good deal just a matter of prejudice and opinion. I had just as good success with the first Double reamer as the last one, so far as reaming was concerned.

I like the new style or wide cutters of the Double underreamer a little better than the old ones. I have not run any of the old style Double underreamers for

(Testimony of T. M. Frampton.)

six years. I have seen them. I see them every day. They have them. They have them there, they will use and do use when they have that size holes to run with. They are the odd-sized reamers. The reamers the Central Oil Company now purchase are the later type with broad cutters.

The North underreamer was not a practical underreamer in my estimation.

Q. 68. Now, what was the trouble with the North reamer, back to 1901 or 1902?

A. Well, there was not very much of anything about it that was any good, to my estimation. There was a very good idea about it but it didn't seem to ever work out practically.

Q. 69. Perhaps was not made the right dimensions, I suppose?

A. Yes; that part of it was all right. And it was more of an experiment, then, but one great trouble was getting the [369] cutters in and out, at that time, that we had with it, and after you got them down the hole they were hard to get out, and they were hard to get down.

You could not tie the cutters of the north reamer, as I recollect it. It has been a good while ago. No, you could not tie the cutters of the North reamer—I know you could not—because the cutters haven't anything to do with going down the hole in the North reamer as I used it.

I ran the first Plotts' underreamer that was ever made. That was in 1897. It is not a practical reamer. It is too slow. Oh, yes, it reams. You can

(Testimony of T. M. Frampton.)

get casing down if you can get time enough, but, to my knowledge there is none of them being run at the present time. I know that the Murphy Oil Company, on the Plotts property, is running the Double reamer at the present time. All the wells I have been to lately are running the Double reamer. I don't know that that is the only reamer. I do not think that the fact that there is no "sub" in the Wilson reamer as there is in the Double is an advantage.

Q. 95. How do you explain it that, as you say, the Wilson reamer won't stand up as well as the Double reamer?

A. Well, there is not anything at the bottom of the cutters. You understand what I mean?—that, when you are reaming, the whole pressure of your cutters is in at the bottom, and the Wilson reamer is hollow there; there is only two little places on each edge for the cutters to go against, while, the Double reamer, you have the solid body; the reamer sets solid, the cutters set solid against something.

Q. 96. You say you have never had any breaks of cutters?

A. The cutters don't break, but it wears the reamer so fast you can't get your hole large enough for the reamer.

Q. 97. Where does it wear?

A. On the bottom, where the cutters set against the [370] reamer. There is where the Wilson reamer won't stand the racket that the Double will.

Q. 98. You mean to say that the metal breaks down at this point?

(Testimony of T. M. Frampton.)

A. It wears; the cutters, working in it, wear out in a little while or no time. That is the reason they have to cut them back.

Q. 99. Did you ever have to scrap a Wilson reamer because of this wear? A. What is that?

Q. 100. Did you ever have to scrap a Wilson reamer because of this wear—throw it in the scrap heap?

A. Oh, I don't know. They have a lot of them out at the scrap-heap. They make sockets out of them.

Q. 101. And Doubles, I suppose, also?

A. Yes, sir.

Q. 102. I mean, have you ever, to your knowledge, to your recollection, had to throw a Wilson in the scrap heap because it wore in the body?

A. Yes, sir; lots of them out there. I don't know what they do with them, but they take them away.

Q. 103. That was after a long period of wear, was it not?

A. Not very long. We have one Wilson at the present time that the bottom of it is practically wore out and we didn't ream over one hundred and fifty feet with it. Of course the reaming was very hard.

Q. 104. You have Double reamers give out, I suppose, after exceptionally hard work, also?

A. Oh, they will wear out; yes.

The difference between the Wilson underreamer and the Double is that one is open at the end and the other is solid at the end. [371]

Q. 117. (By Mr. LYON.) You say the cutting of

(Testimony of T. M. Frampton.)

the bottom of the Wilson reamer out so that it has no central bridge between the ends of the body of the reamer weakens it. Now, comparing simply the mode of securing the expansion of the two reamer bits and the way in which the bits work, what difference, if any, in your opinion, is there between the Double and the Wilson reamers in that regard.

A. Well, the only difference is the construction of the cutters. The cutters are, you might say, two different styles of cutters altogether. One pulls up and expands from the bottom of the reamer and the other expands from the make of the cutter.

Recross-examination.

(By Mr. BLAKESLEE.)

Q. 125. In the Wilson reamer it is the cutters themselves that give the extension, is it not? That is, the expanded bearing surface on the cutters acts upon the forks at the lower end of the body?

A. That expands it?

Q. 126. Yes.

A. Well, I don't see how the cutters have anything to do with the spreading of it. In my opinion it is all in the bottom of the reamer that causes the spreading.

Q. 127. What I mean is, it is the bottom of the reamer, in connection with its side extension or bearings that causes the expanding? A. Yes.

Q. 128. And in the Double reamer it is the inner faces of the cutters acting upon the solid lower end of the body that causes the expansion, is it not?

A. Yes, sir; something which is pulled over.

(Testimony of T. M. Frampton.)

Q. 129. In other words, it is the action of a wedge interposed between the bodies of the cutters in the Double reamer?

A. No, the wedge is there, and in order for the— Well, I hardly know how to explain that myself. The cutters being—one expanding from the shape of the cutters—you see the cutter drops under in the one reamer, and the other it slides down on it. [372]

Q. 130. In the Wilson the cutters slide down and close in together, do they not? [373]

A. Yes.

Q. 131. Whereas, in the Double?

A. They slide down and hook over.

Q. 132. They slide down and hook under the wedge-shaped bottom of the body? A. Yes.

Q. 133. And there are projections on the inner faces of the Double cutters? A. Yes.

Q. 134. That hook in under, are there not?

A. Yes.

Q. 135. And there are no such projections on the Wilson cutter? A. Not on the inner side.

“I am acquainted with Tom O'Donnell, of Los Angeles. He had an underreamer that he tried on a well that was drilled for—I guess he was perhaps interested in the company—on the El Moro. I was not there and seen the reamer used but only know what I was told. It was just prior to the time that I had the experience with the North reamer. The circumstances were these: I saw them bringing the O'Donnell reamer away from there, and they had had a lot of trouble with it, getting it out of the hole,

(Testimony of C. L. Keiser.)

I guess. At least that is what they told me. They went up there and brought it down past my well where I was working; and I went out and looked at the reamer, and I was very anxious to see a reamer with the cutters in the bottom. That was the first reamer I ever saw that the cutters worked in the bottom. And from what I knew and what I talked with the boys, I was acquainted with them all, they said they had had a great deal of trouble with it up there. It was Moranville and Bailey had it on a buggy. Moranville is dead. Bailey's full name is Hibben Bailey. I know it was at the time I was working on the first well for Mr. Off, 1900, 1901." [374]

Testimony of C. L. Keiser, for Complainants (In Rebuttal).

Mr. Kesier, called as a witness on behalf of complainants in rebuttal, testified as follows:

I live Whittier, California. My business at present is ranching. I have been connected with oil well drilling—was a driller. Have operated in the Whittier field for the Central Oil Company and the Fidelity Oil Co. I am familiar with underreamers and have used them. Have used the Double underreamer, the Wilson underreamer, the Plotts and the Leidecker. I just tried to use the Swan or Leidecker. It was not a success with me. It never did any cutting to amount to anything. I attempted to use it several times. [375]

It wouldn't work. The cutters would not work. I attempted to use it several times—I don't know how many times. I have used the Plotts under-

(Testimony of C. L. Keiser.)

reamer some. Not very much. Have not used the Wilson very much. I like the Double reamer the best.

I have lost cutters off of Double underreamers, yes. I expect three or four on the four inch or four and a half Double. In trying to straighten a crooked hole I have knocked them off. We got a shoulder and we got to drilling before we knew it. That is the only way I knew it. There is nobody can look down the hole and see; but that is my opinion. I know that when we started to drilling we had to drill instead of clean out.

Have used the Plotts reamer in several holes. It was very poor success, that is, as far as fastness was concerned. It will ream the hole but it takes a long while to do it—that is if it is not too hard. We never had very much success with the Plotts reamer but where the Plotts reamer is used and the rock is not so hard they get along with it very well, but in hard rock we never had any success with the Plotts reamer. We used the old style Double reamers on the Fidelity and Central. We used both styles.

I like the new style Double underreamer the best because it is the strongest. The body is stronger and the cutters are stronger.

Testimony of Louis Teatsorth, for Complainants.

Mr. Teatsorth testifies as follows:

I live here in Los Angeles. I am a well driller. I have worked in Orcutt, California. I attempted to use the so-called North Improved Underreamer. I secured that underreamer from Mr. Youngken.

(Testimony of Louis Teatsorth.)

He was with the Union Tool Company. [376]

Well, we were drilling several wells, and were short of reamers on Hobbs No. 6—8 $\frac{1}{4}$ —so I went and saw Youngken and asked him if he would give me a Union Tool reamer. He said he hadn't any in stock at the present time but he had an improved North reamer and he thought they had improved on them so it was going to be very satisfactory and he recommended the reamer to me to try. I took the reamer and run it in the hole. I think the hole was about 2,200 feet. Got it down to the bottom, pulled up to find the shoe and we pulled up the shoe. We worked about eighteen hours trying to work the reamer up into the casing but never succeeded in getting it back into the shoe. So we had to pull the casing in order to get the reamer out. When we recovered the reamer we found that the T-head had been bent over to one side. One lug was hanging down and the other was virtually up. We never done anything only we run it to the bottom, run it to the shoulder where we were supposed to start to ream, and pulled it back up to find the shoe in order to know that we were right. Well, we never could get it back up into the shoe.

After we got this North improved reamer out, I reported to Mr. Youngken the condition, the trouble we had had with the reamer and the condition the reamer was in when we pulled it out of the hole. I could not account for the bending of the pin that held the cutters. I have explained as near as I can the condition of the reamer when we pulled it out; that

(Testimony of Louis Teatsorth.)

T-bolt was pulled over down at one side; one of the lugs was down and the other was up. We worked there about eighteen hours trying to pull it into the shoe. Did not try the reamer after that.

That reamer was like the reamer shown in "Defendant's Exhibit Union Oil Tool Company circular of North Improved Underreamer."

I think that was in 1905 or '06.

They gave us a Double reamer in place of it.
[377]

Testimony of George L. Case, for Complainants.

Mr. Case testifies as follows:

My name is George L. Case; I live on Florence Ave., Hollywood. I am connected with the Amalgamated Oil Company at present. Am a well driller. I am drilling in the Salt Lake field at the present time. We have Double reamers there. We also have the Wilson reamers there.

In the Salt Lake field at present we are using the Double reamer. At first we used the Double. After that the Wilson. The company still has a full set or string of Wilsons of the various sizes. The reason for the use by the Amalgamated Oil Company or Salt Lake Oil Company of California in the Salt Lake field, of the Double reamers and the nonuse of the Wilson reamers now, is the Wilson reamer could not stand the work. The bolt on the bottom was always breaking with them. In case the spring or anything would break you would lose the inside working of the reamer by it. I have known of the Wilson reamers breaking while in use in the Salt

(Testimony of George L. Case.)

Lake field. The bolt would break and when you go to put in another bolt you would find the bottom sprung out so you could not get the bolt in. I notice there is a slight spring outward of the bottom end of the Wilson reamer "Complainant's Exhibit Wilson Underreamer No. 2." When the Wilson reamer springs out like that we cannot get our other bolt in. The bolts break right in here, any place between the end there, the center. Occasionally I have had the cutters or lugs of the Wilson reamer break; also those of the Double; we never keep track of those so I cannot say whether we broke more Wilson or Double cutters. The spreading of the bottom was the greatest fault of the Wilson reamer. We always figured that it was this spreading of the bottom that caused the bolt to break. They wouldn't break unless that was spread. I always laid that to the strain of the prongs. It appeared that [378] the action on the shell spread the prongs out.

When the bolt breaks the bottom would spring out so you could not get the bolt in. It gave no trouble in withdrawing the reamer into the casing shoe.

I prefer the Double underreamer because it has always given better satisfaction.

The last time I saw the Wilson reamer the bolt was broken.

I would not call the Canadian underreamer shown by model a practical device. I would not care to run the Canadian underreamer. I do not like the lugs, they are too long. They are too weak also. The Wilson and the Double are the only reamers I have

(Testimony of George L. Case.)

ever used. My knowledge is limited to those reamers. I have seen Austrian underreamers but have never used them.

The safety bolt of the Wilson underreamer has nothing to do with spreading its cutters.

The only trouble the spreading of the reamer body caused when the safety bolt broke out was that we could not put a new safety bolt in it while the lugs or forks were spread apart. The prongs would be spread only about half the thickness of the bolt. Never enough spread to cause trouble to withdraw the reamer into the casing.

A reamer like "Defendant's Exhibit Small Working Model of Day Device" would have too much side motion; there is nothing to keep it from working to the side. The cutters would thrust against the bottom at the lower end but in turning the reamer would bind the cutters. The cutters are free, that is the objection. The cutters spread by tilting over wedge-like formation between them. It may ream in certain kinds of reaming but I would hate to run it.

With the reamer shown in "Oil Well Supply Company's Limited of Canada's catalogue 41½" reamer the thrust of the cutters is taken up at the upper end. The cutters are spread and contracted over the lower end of the body. The cutters are too long, [379] that is the trouble. There is nothing to keep the cutters from working side wise. I guess that is about all. The purpose of the bottom bolt of the Wilson underreamer is to strengthen the reamer.

(Testimony of George L. Case.)

In my experience with the Double and Wilson reamers I [380] have never found that the casing would follow one better than the other.

**Testimony of John S. Culver, Called on Behalf of
Complainants (in Rebuttal).**

Mr. Culver testifies as follows:

I reside in Whittier; my business is drilling. Have been in the business since 1900. I have drilled in the Whittier Field, in the Coalinga field and in the Midway field. At Whittier I worked for the Central Oil Co. I am familiar with underreamers and have used them. I have used the Austrian underreamer, the Plotts underreamer, the Double underreamer and the Wilson underreamer. Also have tried to use the Swan underreamer. We had trouble to get the Swan underreamer down in the hole, and out of the hole. We did not accomplish much with it. We put in most of our time, when we were using it, getting it out and in the hole—trying to use it.

The Austrian underreamer did the work if you could give them time enough, and the same can be said of the Plotts reamer. I consider the Double reamer or the Wilson reamer either better than the Plotts or the Austrian. I had a little trouble with the Wilson underreamer in getting the hole large enough for the casing to go through. That was the only trouble I had with it. I had an old Austrian underreamer set over and I finished the hole with the Austrian underreamer. I reamed the shell with that Austrian reamer. They had no Double reamer

(Testimony of John S. Culver.)

that we could get hold of and they had an Austrian so we took it. As to the relative strength of the Double underreamer and the Wilson underreamer I don't know that I have tested their strength. From what experience I had had I have thought that the Double would stand a little the most.

The Double has been my preference since I have been using them. I don't know that I prefer it any more than I like the reamer the best. [381]

The Double seemed to do the work and I had less trouble with it. I never had any trouble with the "sub" or middle joint of the Double reamer.

I have been able to ream the hole a little larger with the Double than with the Wilson.

We ran the Austrian underreamer just the same as any other reamer.

We broke a great many cutters of the Austrian reamer and had different kinds of trouble. Sometimes they would wear and not lock. They were not strong enough.

I like the new style of Double reamers namely, the Improved underreamer better than I do the old style. It is a little stronger reamer, has a little more bearing surface underneath the cutters and that of course is due to broadening of the cutters. I think we had more trouble with the old style Double reamer cutters than we had with their improved style. I think the broader cutters with their bearings against the lower end of the body gives a better bracing action or relation. I have broken Double underreamer cutters.

**Testimony of James Kramer, Called on Behalf of
Complainants.**

Testifies as follows:

I live in Los Angeles, Blacksmith by occupation. Am at present employed by the Salt Lake Oil Company. I worked for the Wilson & Willard Mfg. Company in about the year 1911. Was with them for about six months, employed as a blacksmith. While I was there I think I saw one Wilson & Willard underreamer which was broken at the end. (Witness points to the point below the thrust bearings and contained the thrust bearings, and just in line with or above the bottom bolt of the Wilson reamer.) I do not know how that Reamer was broken. I have seen them in the oil fields [382] that were broken.

Q. 36. Where was it that you saw the other Wilson & Willard reamer bodies that were broken?

A. Around the shop there. I don't remember just where they were, but they were laying in the shop.

Q. 37. Do you mean to say that you saw others that were broken clear across at the lower end?

A. Out in the Salt Lake oil fields.

Q. 38. How many did you see of that sort?

A. I don't know. I didn't just count how many.

Q. 39. Do you know when the breaks occurred?

A. No; I didn't know when they occurred.

Q. 40. Did you see the breaks? A. Yes, sir.

Q. 41. Did you see them just after they occurred?

A. I don't know how long it was after they had occurred that I saw them.

(Testimony of James Kramer.)

Q. 42. Have you any knowledge of how the breaks occurred? A. No; I do not.

Q. 43. Do you know where any of these broken Wilson reamer bodies you have referred to are now?

A. No, sir.

The broken tee-rod of the Wilson reamer is "Jumped" that is in making the tee-rod you take a piece of steel or iron and jump those pieces on. You weld those pieces on, yes, sir. Comparing the Wilson tee-rod with the mandrel of "Complainant's Exhibit Double Underreamer" would be the stronger. My reasons for saying that is when you heat the tee-head of the Wilson reamer you take the carbon out of it and you don't know—you might get it too hot, or not hot enough. You may get a good weld on the outside but you don't know what you have on the inside. I never saw any of the Spring Actuated rods welded in the Wilson & Willard [383] Mfg. Company's Shop. As a matter of fact, when I was working there, they always forged these tee-rods. The tee-head was forged in one piece. They would draw them out under the hammer. I don't know how the broken reamer body I saw on the Salt Lake fields occurred.

I don't think it weakens the construction of the Double reamer rod to slot it through for the purpose of placing the key in it.

Forging the Wilson Tee-Head would be less expensive than to weld them on.

The more you forge a piece of steel the less carbon there is in it and it makes it that much poorer. I

(Testimony of James Kramer.)

haven't had very much experience in metal working. I don't know how much carbon there is in any steel. I never made any tests. I am not familiar with and don't know anything about Bessemer processes of refining iron. While working at the Wilson & Willard Shop I welded up rods and worked around the furnace.

I don't know how the Wilson reamer bodies were broken.

Testimony of William Williamson, Called on Behalf of Complainants.

Mr. Williamson testifies as follows:

I reside in the city of Los Angeles. Am an Oil Well Driller. Have been drilling for about twenty years. Came to California in about 1900. Am familiar with underreamers and have used them. The first underreamer I used was an Austrian underreamer. I cannot recall what trouble I had with it or what success. The next reamer I used was the Double. That was in 1902. I did the work with it I had to do. It was successful; yes, sir. I have used the Double reamer on and off ever since.

I also have used the Wilson reamer. I think I have tied [384] the cutters of both reamers. In the large sized reamers the spring is very stiff and the reamer goes down better with the cutters tied. I usually tie them anyway rather than have the trouble getting them through the pipe. I don't believe there is much difference in the sized hole the Wilson or Double reamer cuts. I once have broken

(Testimony of William Williamson.)

Double underreamer cutters. I broke one end of the key, and lost one cutter. That was the old style Double reamer.

I believe the Double reamer is the strongest as a whole.

I believe the dovetails in the Double reamer is the stronger. The cutters of the reamers contract and expand in the same manner.

The latest or improved style of Double underreamer is supposed to be the stronger reamer. On account of the dovetail seats. (Witness points to V-shaped groove at the bottom of Complainant's Exhibit Double Underreamer, or each side thereof.) The knives or cutters are heavier also. You can do better work with the later improved Double reamer for the reason that you can run it harder.

I would hate to run a reamer like the Canadian underreamer. Not knowing the contraction and expansion of those knives it would be hard for me to give you the reason. I would not consider it had expansion enough. I would not consider that it had near the strength of the Wilson or Double reamer has. I would not consider the Day underreamer a practical underreamer. I believe that in running this reamer you were running in blue shale it would be very hard to get the reamer back into the pipe again. That is, in reaming blue shale.

The extra width of the body or bearings underneath the V-shaped dovetails at the lower end of the Double improved underreamer body is an advantage, it enables the use of a stronger cutter and gives more

(Testimony of William William^son.)

stock to the cutters or knives, hence they will last longer. I don't believe there is any better results secured in use [385] by the broadened cutter of the Double improved reamer over the old type Double.

There is more stock in the dovetails of the Wilson underreamer body than there is in the Double. That would make the dovetails stronger.

Q. 74. Then please reconsider the question with the following explanation, namely: That by tilting I mean that action which permits or causes the cutters to move into or out of contracted position.

A. I don't believe there is any difference between the two underreamers.

Q. 75. Then, do I take it that you mean to imply that there is a portion of the body directly between the bodies of the cutters in the Wilson underreamer exhibited, over which the bodies of the cutters move or play in expanding or contracting?

A. They both expand and contract the same, as far as I can see.

Q. 76. In the "Complainants' Exhibit Wilson Underreamer," the lower end of the body is bifurcated, is it not, or composed of two straight parts between which there is simply an open space? A. Yes.

Q. 77. Then, there is nothing at that part of the cutters to bear on, is there? That is, where it is open?

A. When the underreamer is in use there is no bearing there.

Q. 78. And there is nothing there that the cutters

(Testimony of William Williamson.)

bear on, is there? A. No, sir.

Q. 79. And in the Double underreamer, as for instance in "Complainants' Exhibit Double Underreamer," there is a combination metallic formation, is there not, across the bottom, in connection with which the bodies of the cutters work?

A. Yes, sir. [386]

Q. 80. Do you find in the Wilson cutters any such formation as the formation in the inner or working face of the shanks of the Double cutters in the form of a cut with an abrupt shoulder which engages with the lower end of the body of the reamer in the contracting and expanding action?

A. There is on the Double.

Q. 81. Do you find it on the Wilson cutter?

A. I don't believe there is on the Wilson cutter.

Redirect Examination.

(By Mr. LYON.)

Q. 82. What is it, Mr. Williamson, that is utilized in the cutter of the Wilson underreamer to cause the bits to ride out on the spreading-surface?

A. I don't believe I understand that question.

Q. 83. You have stated that there is no shoulder like the shoulder on the Double cutter. Now, what is there that causes the Wilson cutter to move outward when pulled up in the reamer?

A. The shoulders are in a different place on the cutters.

Q. 84. And how do they act?

A. Practically the same thing.

(Testimony of William Williamson.)

Recross-examination.

(By Mr. BLAKESLEE.)

Q. 85. The shoulders on the Wilson cutters or lugs which you have just referred to act upon the prongs or side portions or spaced side portions at the lower end of the Wilson underreamer, do they not?

A. Yes, sir. [387]

**Testimony of E. C. Wilson (Continued), for
Complainants.**

Being subpoenaed as a witness for the Complainants.

The method of contracting and expanding the cutters is substantially the same in "Complainant's Exhibit Double Underreamer" and in the device of "Defendant's Exhibit Wilson Patent." I misunderstood the question. I understood that Mr. Lyon was asking me to make a comparison of the expansion of the cutters of "Complainants' Exhibit Double Underreamer" with the Double underreamer patent. The mode of expansion and contraction of the Double underreamer cutters as shown in "Complainants' Exhibit Double Underreamer" differs very materially from the mode of expansion and contraction of the cutter of the Wilson underreamer patent.

As I understand the term "mode of operation" it might be said to be the same, when comparing the two devices intended to perform the same duty, such as a LeFever shotgun, or a Parker shotgun, or a Smith shotgun. The mode of operation is exactly the same but the devices employed in those differ-

(Testimony of E. C. Wilson.)

ent guns to perform that operation or to perform the results obtained by the mode of operation, may be entirely different and each one in themselves patentable. I consider there is a difference between the "principle of action" and the "mode of operation." The Wilson patent as shown and described therein embodies a different "principle of action" of the parts in expansion and contraction of the bits or cutters on "Complainant's Exhibit Double Underreamers."

Q. 914. Then, do you understand, and testify, from your mechanical knowledge, that the extension of the spreading-surface of "Complainants' Exhibit Double Underreamer" to the periphery of the body, and the corresponding extension of the expanding shoulders of the bits to bear there against, involves the same mode of operation as in "Defendant's Exhibit Wilson Underreamer Patent," so far as the expansion and contraction of the bits are concerned? [388]

A. The mode of operation, namely, the acts or forces required, and which must be applied to the cutters to expand or contract them—I mean those forces employed which are in nowise any part of the reamer itself—is not changed by the change in design occasioned by extending the spreading-bearings to the periphery of the body. That principle is old; it has been used on various underreamers long before Mr. Double ever employed it.

Mr. LYON.—Complainants move to strike from the answer and exclude from consideration that por-

(Testimony of E. C. Wilson.)

tion of the answer beginning with and following the words, "That principle is old," on the ground that it is not responsive to the question, and not the best evidence, and incompetent.

Q. 915. What forces, in your last answer, or acts, do you refer to as not being in anywise any part of the reamer itself.

A. I mean the forces that are employed to draw the cutters downwardly overcoming the tension of the spring so that they will collapse over the end of the hollow slotted extension.

Q. 916. Now, so far as the underreamer, "Complainant's Exhibit Double Underreamer" is concerned, in its mechanical embodiment, and the device described and shown in "Defendants' Exhibit Wilson Underreamer Patent," is concerned, from your understanding of mechanics do you understand that the extension of the spreading-surface of "Complainant's Exhibit Double Underreamer" to the periphery and the corresponding extension of the expanding shoulders of the bits thereof to bear there against involve the same mode of operation, or do they involve a different mode of operation?

A. The same mode of operation will collapse the cutters or expand them to reaming position.

Q. 917. Based upon your knowledge of mechanics, does this extension of the spreading-surface of "Complainants' Exhibit Double Underreamer" to the periphery and the corresponding extension of the expanding shoulders of the bits thereof to bear there against, [389] involve the same principle of ac-

(Testimony of E. C. Wilson.)

tion in the expansion and contraction of the bits or cutters as is involved in the device shown and described in "Defendants' Exhibit Wilson Underreamer Patent"?

A. There is a different principle of action.

Q. 918. In what does that different principle of action consist, in your opinion?

A. Well, that question will require considerable time to answer. It has been answered two or three times before, and at considerable length.

Q. 919. You should be capable of a concise answer; and, will you please give it, so that we may know exactly what you have in mind after a complete study of the matter?

A. The means employed to expand the cutters of the Double underreamer—either Complainants' Exhibit or Defendants' Exhibit Double Underreamer—consist of three main features: First, is the stationary wall or partition, so placed on the reamer body itself, and integral with the body, that it forms a wedge or a spreading-bearing between the cutters. The faces of this stationary wall are parallel, that is, the bearing-faces or the opposite faces on which the cutters rest when in expanded position. The cutters themselves have V-shaped grooves planed across the backs of the cutters, and which grooves are necessary in order to permit the cutters to collapse over this stationary wall or partition, or hollow slotted extension, as it is repeatedly termed in the Double underreamer patent. In addition to the tilting action or collapsing action of the cutters, namely, the

(Testimony of E. C. Wilson.)

action produced by swinging the cutting end of the cutters toward each other as the cutters are collapsed over the spreading-bearing of the reamer body when the cutters are drawn down sufficiently for them to slide over and below the lower end of the hollow slotted extension, there is an additional means employed to enable them to collapse and also to assist in expanding them, and that is due to the upwardly and inwardly [390] inclined grooves, which form pockets to engage the shanks of the cutters. By reason of these pockets being at an angle with the vertical line of the reamer body, the angle being inwardly and upwardly, the cutters are obliged to follow the trend of these R. 1036 grooves when being drawn downwardly to collapse the same, or when being drawn upwardly by the power of the spring when expanding them to reaming position. Now, the combination of the wedge-like action of the hollow slotted extension, also by reason of the beveled face on the projection or shoulder on the inner faces of the cutters, which projection or shoulder is produced by the V-shaped grooves planed across the backs of the cutters, also by the additional action or force occasioned by the angularly planed grooves or channels in which the cutters travel, all together produce the contraction and expansion principles of action of the Double underreamer in both defendant's and complainant's exhibits. In other words, there are means on the cutters themselves, and also on the bodies, the combination of which means produce the action. To obtain this action it is necessary for the

(Testimony of E. C. Wilson.)

cutter to teeter during the time of its collapsion or expansion. When the cutters are being collapsed the upper end of the cutter, namely, all of that portion of the cutter which is above the point of contact on the spreading-bearing of the body, tilts outwardly and slides upon the key to which it is suspended while so doing. The lower end of the cutter tilts inwardly at the same time. Thus, the cutter produces a teetering action, the fulcrum being at the point of contact at the inner face of the cutter, where it bears against the spreading-bearings of the reamer body. Now, with the Wilson underreamer, there is no such teetering action. It is true the extreme upper end of the cutter has a tendency to tilt outwardly while the cutters are being collapsed and drawn downwardly into collapsed position, but it is only that portion of the cutter which is above the suspension means—very different from the Double cutters, as his cutters tilt [391] outwardly above the bearing points or points of contact on the reamer body. With the Wilson reamer the cutters do not slide inwardly or outwardly upon the suspension-means or T; they merely swing from the suspension-means as a pendulum swings. The expansion or contraction of the Wilson underreamer cutters is produced by the following means: The tapering ends or wedge-like projections which form the lower extremities of the forks or two prongs of the reamer body act as wedges or spreading-bearings upon which the cutters ride. The points on the cutters which contact with these spreading-bearings of the

(Testimony of E. C. Wilson.)

reamer body are placed in an entirely different position on the cutter from the point of contact on the Double underreamer cutter. The Wilson underreamer cutters are so formed that the main body of same projects a considerable distance to each side of the shank of the cutter. These projections form shoulders which are machined to correspond with and to rest upon the wedge-like projections on the ends of the prongs or forks of the Wilson reamer body. There are no V-grooves planed in the backs of the Wilson underreamer cutters, such as are found on the backs of the Double cutters, for the reason that they are not needed; there is no occasion for them. The design of the Wilson reamer body is such that when the cutters themselves are collapsed together there is no part of the reamer body itself interposed between the cutters. To collapse them they are simply drawn down until the shoulders on the extended body, or widened body, ride over and below the spreading-bearings or wedge-bearings on the ends of prongs of the reamer body. The cutter, being suspended on a T, merely swings inwardly from its suspension-means. There being no material between the two cutters, that is, no portion of the body itself, there is nothing to prevent the cutters from swinging toward each other as they commence to collapse while riding down the taper-faces of the spreading-bearings of the reamer body. To expand the cutters, the force of the spring draws them up as they bear on the spreading-bearings [392] of the prongs of the reamer body, and the wedge- action

(Testimony of E. C. Wilson.)

together with the taper face of the spreading-bearings finally crowds them out into full expanded position. I think that is all. No; I might add: The upper ends of the Wilson cutters do not come in contact with any angular faces or any angular grooves to in any way assist them to collapse or to expand. There are no such means employed on the Wilson underreamer, and that feature alone makes a very marked difference in the principles of action between the two designs of reamers.

Q. 920. Then, to sum up your conclusions, the principles of action of "Complainants' Exhibit Double Underreamer" and of the device of "Defendant's Exhibit Wilson Patent," in expansion and contraction of the bits or cutters, are distinctly different and not substantially the same? Is that your testimony?

Mr. BLAKESLEE.—Objected to as leading, and as attempting to place a construction arbitrarily upon the preceding testimony of the witness.

Mr. LYON.—Read the question. (Question No. 920 read by the Special Examiner.)

Mr. BLAKESLEE.—And as calling for an arbitrary conclusion.

A. There are very marked differences.

Q. 921. (By Mr. LYON.) Will you please answer the question yes or no? Read the question again. (Question No. 920 re-read to the witness by the Special Examiner.) Give us a yes or no answer, please.

A. They are not the same.

Q. 922. And the "Complainants' Exhibit Double Underreamer" and the device shown and described

(Testimony of E. C. Wilson.)

in "Defendant's Exhibit Wilson Patent" employ distinctly different mechanical principles in the relations and actions of the spreading-portions, thrust-bearings, and inter-engaging dovetails of the bit and body portion, do they?

A. Yes, sir; they do. [393]

Q. 923. Is the principle of action of the co-operative parts in the expansion of the bits or cutters of "Complainants' Exhibit Double Underreamer" and "Defendant's Exhibit Double Underreamer" different, or the same?

A. The means employed to expand or collapse the cutters are virtually the same.

Q. 924. They are identical, are they not?

A. No, sir.

Q. 925. How do they differ? Please note that the question refers to the expansion and contraction of the cutters only.

A. The principles are the same. There is a little difference in the division of force employed to obtain the full expansion or collapsion. One depends more on the taper-grooves which incline upwardly and inwardly and in which the cutters travel than the other does.

Q. 926. Which one of these two devices depends more upon such taper?

A. The later device, I think.

Q. 927. "Complainants' Exhibit Double Underreamer"?

A. "Complainants' Exhibit Double Underreamer."

(Testimony of E. C. Wilson.)

Q. 928. When the bits or cutters of a Double underreamer are collapsed, what function does the metal at the bottom end of the underreamer and lying between the bits in collapsed position, perform?

Mr. BLAKESLEE.—Objected to as indefinite. By “Double underreamer,” does counsel include both of the Double underreamer exhibits which have been discussed by the witness, namely, complainants’ and defendant’s, or only one, and, if one, which?

Mr. LYON.—Both of them. The witness has stated that they are the same, so far as the principles of action of the collapsion and contraction of the cutters are concerned. Read the question to the witness. (Question No. 928 read to the witness by Special Examiner.) [394]

A. It acts as a stop or a retaining-means, an abutment over which the shoulder across the back of the Double cutter engages or hooks onto that portion of the reamer body, holding the cutters in collapsed position and overcoming the tension of the spring.

I have never signed any interest in the Wilson underreamer patent to anyone. I am simply a customer of the Wilson & Willard Manufacturing Company so far as the manufacture of the Wilson underreamer is concerned.

E. C. WILSON, recalled.

Direct Examination Resumed.

(By Mr. LYON.)

Q. 935. Referring again to “Complainants’ Exhibit Double Underreamer,” if the bits of this reamer were cut away so that that portion of the bits on the

(Testimony of E. C. Wilson.)

inner faces registering with the shanks were not raised above the inner face of the shanks of the bits but continued straight and did not contact at any time with the spreading-surface, would the principle of action of the parts of such underreamer in expanding or collapsing remain the same as now embodied in the exhibit "Complainants' Exhibit Double Underreamer"?

A. I think you are mistaken in your statement that the raised portion of the cutter at the back of the cutter projects beyond the back of the shank of the cutter. The projection or portion of the back of the cutter which comes in contact with the spreading-face of the hollow slotted extension is in exact plane with the upper end of the back of the shank—back of the upper end of the shank—so that before the material is planed out to form the V-shaped grooves the back of the shank of the cutter is a flat plane.

Q. 936. Well, you seem to have identified without difficulty the portion that I have referred to. Now, if the portion that I [395] have referred to were cut away so that for the widths of the shank of the cutter there was no contact of the bit at any time with the spreading-surface, would the principle of action of the parts in expanding or collapsing be the same as now embodied in the exhibit underreamer "Complainants' Exhibit Double Underreamer"?

A. Do I understand you to mean that if this entire bearing point was removed, or only that portion of it

(Testimony of E. C. Wilson.)

which constitutes the back of the shank of the cutter?

Q. 937. That portion which is of the same width as the shank of the cutter.

A. A certain amount of the back of the cutter would have to remain in order to give it the full expansion that the cutter has in its normal state. With that portion of the back of the cutter remaining intact, namely, that portion of the bearing which is on the body proper of the cutter and which forms the faces on the body and on the projecting shoulders of the body—if that remained, the cutter would expand to position over the spreading-bearing as now, although its action would probably be modified by reason of the changed position of the lower wall or shoulder of the V-shaped groove lowering the same further down on the shank.

Q. 938. You say that the action would be modified. Would it still be the same principle of action?

A. Yes, sir; it would. There would be simply a modification of the amount or extent to which the cutters would be expended or contracted.

Q. 939. Now, again referring to cutting away the portion of the shank of such cutter or bit at the point that you identified for me in response to my previous question, and cutting that deep enough so that no portion there would contact, and permitting the contact to come only at the sides of the extension on the body beyond the width of the shank of the cutter, and permitting only those points or shoulders to contact with the end or expanding surface of [396]

(Testimony of E. C. Wilson.)

“Complainants’ Exhibit Double Underreamer,” would such bit then used in “Complainants’ Exhibit Double Underreamer” have the same principle of action in expansion and contraction as is present in said exhibit with the cutters in the form shown in said exhibit, or would it be a different principle of action? A. It would be a different action.

Q. 940. Would you say distinctly different action from that now embodied in “Complainants’ Exhibit Double Underreamer?”

A. It would eliminate one of the means now employed by Double and as exhibited by “Complainants’ Exhibit Double Underreamer,” to expand the cutters.

Q. 941. Then, in your opinion, as a mechanic, it would form a distinct device, would it?

Mr. BLAKESLEE.—Objected to as indefinite; and, also, as leading.

A. It would be a different device; yes, sir.

I have instructed Mr. Raymond Ives Blakeslee, one of my counsel, to notify the Union Tool Company that the manufacture and sale of Underreamers like “Complainant’s Exhibit Double Underreamer” was in my opinion an infringement of the letters patent #827,595, namely the Wilson underreamer patent.

Such instructions were given by me after I finished giving my deposition in this case on behalf of the defendant.

Q. 946. (By Mr. LYON.) And you fully considered, in that connection, the principles of opera-

(Testimony of E. C. Wilson.)

tion and the principles of action of the bits or cutters in collapsing and contracting in both said exhibits "Complainants' Exhibit Double Underreamer" and "Defendant's Exhibit Wilson Underreamer Patent," did you?

Mr. BLAKESLEE.—Same objections.

A. I fully considered both matters; yes, sir.

Q. 947. (By Mr. LYON.) And, basing your opinion upon your knowledge of mechanics, you were of the opinion that such "Complainants' Exhibit Double Underreamer" embodied substantially the [397] construction shown and described in such "Defendant's Exhibit Wilson Underreamer Patent," did you?

Mr. BLAKESLEE.—Same objections, and with the added objection that the question calls for a conclusion on the part of the witness or a statement of a conclusion previously reached.

A. I am convinced that the changes made in the design of the Double underreamer, and which changes are embodied in the "Complainants' Exhibit Double Underreamer," employ enough of the principles covered by the Wilson patent to be infringing on that patent.

(By Mr. LYON.)

Q. 948. And you still remain of the same opinion, that "Complainants' Exhibit Double Underreamer" embodies sufficient of the principles of construction and mode of operation, principle of action, of the device of said Exhibit Wilson patent, to be an infringement thereof, do you?

(Testimony of E. C. Wilson.)

Mr. BLAKESLEE.—Same objections.

A. The changes in the Double reamer and improvements thereon, and which changes and improvements are embodied in the “Complainants’ Exhibit Double Underreamer,” are such, in my opinion, as to make that device an infringement on the patent issued to myself, numbered 827,595, issued July 31, 1906.

Q. 949. (By Mr. LYON.) Now, answering as a mechanic, Mr. Wilson, will you please answer the preceding questions yes or no?

(Question No. 948 read by the Special Examiner.)

A. I consider that it employs a sufficient number of the principles of construction to infringe on the Wilson patent.

Q. 950. Do you still consider that the “Complainants’ Exhibit Double Underreamer” embodies the same principle of action, mode of operation, interrelation of the parts, as shown in “Defendant’s Exhibit Wilson Underreamer Patent”? Please answer this yes or no? You can readily do so.

Mr. BLAKESLEE.—The same objections. [398]

A. They do not use the same principles of action.

Q. 951. (By Mr. LYON.) In the expansion and contraction of the cutters, do they use the same mode of operation? Answer yes or no, please.

A. In accordance with my understanding of the term “mode of operation,” as I have endeavored to explain it before, there are numerous underreamers which could be said to be the same in mode of operation, many of which were older than the Double.

(Testimony of E. C. Wilson.)

Mr. LYON.—We move to strike the answer of the witness from the record and exclude it from consideration, as not responsive to the question; and ask that the witness be re-read the question and that he answer it yes or no, and he will be given a full opportunity to make any explanation that he wants after so answering. And demand is made that he confine his answer to personal knowledge and that he do not give matters of hearsay.

(Question No. 951 read to the witness by the Special Examiner.)

A. Will you explain to me what you mean by “mode of operation”?

Q. 952. In you answers you have used the term “mode of operation,” and said that the mode of operation of the “Complainants’ Exhibit Double Underreamer” and “Defendant’s Exhibit Wilson Underreamer patent” are substantially the same. Now, please tell me what you mean, in that answer, by the term, “mode of operation.”

A. I think I explained that by mode of operation, as I understood it, reference is made to the forces employed, or the means, brought into force, to place the machine in operation, such means and forces being separate and apart from any of those employed in the device or machine itself.

Q. 953. Then, you differentiate between “mode of operation,” as referred to in a machine or device, and the principle of action and the manner in which the parts co-act together to secure a given [399] result, do you?

(Testimony of E. C. Wilson.)

Mr. BLAKESLEE.—Objected to as leading.

A. Yes, sir; I think it is proper to make a distinction.

Q. 954. (By Mr. LYON.) Well, I am not asking you, Mr. Wilson, whether you think it is proper to make a distinction, but I want the record to clearly show what you mean by “mode of operation” and whether you use that term as applied to the general method in which a tool or machine is used as distinct from the manner in which the parts of the tool co-operate in the tool to produce a given result.

A. When I say that the—

Mr. BLAKESLEE.—Just a moment. Objected to as leading.

A. When I say that the mode of operation of the Double underreamer, Complainants’ exhibit, and the device covered by the Wilson patent, No. 827,595, are substantially the same, I do not mean that the mechanical construction and application of parts and co-operation of parts or assembling of the parts are the same.

Q. 955. (By Mr. LYON.) Well, then, just explain to us what it is in these two devices that you have last referred to, “Complainants’ Exhibit Double Underreamer” and the device of “Defendant’s Exhibit Wilson Underreamer Patent,” that you term the “mode of operation” and which you say is the same.

A. Well, I will repeat that by “mode of operation,” I have in mind the means necessary to put the machine into operation, such means being out-

(Testimony of E. C. Wilson.)

side of and separate and apart from any of the mechanical means or devices within the device itself.

Q. 956. The well-casing, for one thing?

A. Yes, sir. That has something to do with the mode of operation of the underreamers.

Q. 957. The string of tools and operating line?

A. Yes, sir. That would have its part.

Q. 958. What else?

Q. The act of operation of the drillers in drawing the [400] cutters together—collapsing them, in other words, and holding them collapsed by some device or other preparatory to entering the reamer into the casing; the act of running the reamer down the casing; the act of running the reamer below the casing until the cutters expand to reaming position, and then the action of the tools as applied to the reamer in giving it the necessary stroke to do the cutting or reaming required; the withdrawal of the reamer into the shoe; the downward and collapsing action of the cutters; and the withdrawal of the reamer cut through the casing at the top of the hole.

Q. 959. Now, how much of the action of the collapsing of the cutters do you include in the mode of operation as thus defined by you?

A. To collapse the cutters, whatever means are employed.

Q. 960. You misunderstand my question, again. I do not ask you as to the differences, but I ask you how much of the action of the collapsing of the cutters you include in your meaning of the term, "mode of operation," as you have just been testifying.

(Testimony of E. C. Wilson.)

A. Whatever is necessary to be done by the drillers or the toolies in order to hold the cutters down or to collapse them together.

Q. 961. That is, disregarding the mechanical agencies or parts of the tool devices, including the bits and the parts upon which they act on the body of the underreamer, is it?

A. I have tried to make myself clear by saying that I do not include any of the actions or forces or means obtained from within the machine itself.

Q. 962. Or the interrelation of such parts within the machine?

A. Or the interrelation of such parts within the machine. [401]

Q. 963. And you have used the term, "principle of action," as referring to the principles upon which the bits and other corelated parts of the two devices act within the devices themselves, have you?

A. That is substantially correct; yes, sir.

Q. 964. As you understand the "Complainants' Exhibit Double Underreamer," the V-shaped notches or dovetails at the bottom of the body perform no function whatever in the contraction or expansion of the bits, do they? A. Yes, sir; they do.

Q. 965. In your last answer do you refer to the dovetails in which the shanks of the cutters operate, or do you refer to the bottom V-shaped notches.

A. I mean the change in construction of the Double underreamer occasioned by the V-shaped notches.

Q. 966. What change?

A. The resultant extension of the spreading-wall

(Testimony of E. C. Wilson.)

or hollow slotted extension below the grooves or dovetails in which the shanks of the cutters play.

Q. 967. What difference did this extension make?

A. It makes one of the decided advantages that I have always claimed, and do claim yet, that I have—that I employ—in the construction of the Wilson underreamer, by having the spreading-bearings extending a considerable distance below the dovetails, bracing the cutters firmly apart quite a way down toward the cutting edge, where the force is applied which has a tendency to crush the cutters together, thus more firmly bracing the cutters apart and transferring that leverage which is applied to the cutter from the shank down to a point where the power is applied across the body of the cutter, and which is the strongest part of the cutter and which enables the cutter to more completely and more surely withstand the strains. [402]

Q. 968. Has this change in the Double underreamer changed, in any manner, the principle of action in the matter of expansion and contraction?

A. Well, there is a great deal more to an underreamer than the mere fact of its expansion and contraction.

Q. 969. Will you please answer the question as to the principle of action on which this device now works as contrasted with it before this change was made, and answer the preceding question?

Mr. BLAKESLEE.—The attention of the Court is particularly called to the nature of the present question, and its barrenness with respect to any

(Testimony of E. C. Wilson.)

proper rebuttal inquiry. It is asked that such particular attention in this respect be given this question in connection with the motion which will be made at the conclusion of this deposition.

Mr. LYON.—Read the last two questions and answers, the last one first, and the first one last.

(Question No. 969 read to the witness by the Special Examiner; and Question No. 968 and the answer thereto also read to the witness by the Special Examiner.)

A. Those are about the only features of the underreamer that have not been changed in action.

Q. 970. And they have not been changed; the principles of expansion and contraction remain practically the same as they were before, and, in your opinion, they are substantially different from those of the Wilson underreamer of "Defendant's Exhibit Wilson Underreamer Patent," are they?

A. The means employed to expand the cutters of the Double reamer are altogether different from those employed to expand the cutters of the Wilson reamer.

Q. 971. I ask that the question be re-read to the witness and that he answer it yes or no. (Question No. 970 read to the [403] witness by the Special Examiner.)

A. They are different. Yes, sir.

Q. 972. Radically different or substantially the same—which?

A. There is a radical difference in the form of construction and the means employed to expand the cutters.

(Testimony of E. C. Wilson.)

Q. 973. The difference is so radical as to give an entirely different principle of action in that respect, is it?

Mr. BLAKESLEE.—Objected to as leading.

A. Yes, sir; there is a difference in the action.

Q. 974. (By Mr. LYON.) A radical difference in the action, in your opinion?

Mr. BLAKESLEE.—Same objection.

A. Yes, sir; there is a radical difference in the action.

Letter identified by witness is offered in evidence as “Complainant’s Exhibit Blakeslee Letter of February 3, 1913.”

Q. 979. (By Mr. LYON.) The underreamers referred to in this letter which has just been offered in evidence, Mr. Wilson, were of the type which is exemplified in this case as “Complainants’ Exhibit Double Underreamer,” are they?

Mr. BLAKESLEE.—Objected to as leading, irrelevant, immaterial and incompetent; and as inquiring with respect to a matter manifestly of the nature of a privileged communication.

A. They are.

E. C. WILSON, recalled.

Cross-examination.

(By Mr. BLAKESLEE.)

Q. 980. Please now refer to the V-shaped notches or dovetails at the bottom of the body of “Complainants’ Exhibit Double Underreamer,” which produce the lateral extensions of the spreading wall or hollow slotted extensions, and tell us the function or [404]

(Testimony of E. C. Wilson.)

service of these notches or these notched portions or the resultantly formed lateral extensions.

A. The result of machining those V-shaped grooves is multifold. It extends the wedge or spreading-bearings a considerable distance below the lower end of the ways or dovetail grooves machined in the body. This extension transfers the fulcrum or the point of contact further down on the cutters when the cutters slide or tilt over this spreading-bearing. When the underreamer is in operation, probably the greatest force applied against the cutters, unless it be the actual end-thrust of the cutters against their bearings at the upper ends of their shanks, is the tendency to crush the lower ends of the cutters toward each other. It is evident at once that the more closely or the more nearly we place the spreading-bearing in line between the cutting edges of the two cutters, the more completely that force is resisted, and, consequently, the less leverage is applied to the cutter to offset that force. In the old style Double underreamer the lower extremity of the spreading-bearing, when the cutters were in expanded position, came in contact with the cutter at the lower end of the shanks, just where the shank joins the body of the cutter. The cutter is naturally weaker at that point than it is across the body itself of the cutter. Consequently, these V-shaped grooves have overcome one of the faults of the old Double underreamer, viz.: The application of the strain referred to at the shank of the cutter, and now transmit that strain further down the cutter in such a

(Testimony of E. C. Wilson.)

manner that the strain is now taken up on the body of the cutter. Another one of the advantages gained by these V-shaped grooves over the old style Double underreamer, is the extension at right angles to the shanks of the bearings on the backs of the cutters, which bearings rest on this stationary wall or partition of the reamer body when the cutters are expanded. It will be quite clear that this extension of these bearings brace on the cutters and prevent a tendency of the cutter to rotate [405] from side to side. To have widened the shoulders of the old style Double underreamer sufficiently to give the additional cutting surface desired and which is now obtained by the improved Double underreamer, as shown in "Complainants' Exhibit," it would have been done at the risk of throwing a very considerable additional strain to that cutter, where the forces would be applied, at one corner of the cutter and not at the other. The tendency would be, as suggested before, to rotate the cutter in the dovetails, throwing the heavy outward strain at one side of the shank and an inward strain on the cutter on the opposite side of the shank. Consequently, it would probably have been altogether impractical to have widened the body of the old style Double underreamer cutter without some means of extending the bearings at the backs of the cutters correspondingly. This could not have been done with the old style Double underreamer cutter, as by that form of construction there was no point on the old style Double underreamer body on which said bearings on the cutters could have rested.

(Testimony of E. C. Wilson.)

Q. 981. Please read the question. (The Examiner reads Question No. 980.)

Mr. LYON.—We move to strike out the preceding answer of the witness from the record on the ground that it is not responsive to the question.

A. Another advantage gained by the improved Double underreamer, as shown by complainants' exhibit, over their old style reamer, is the additional amount of stock or material which they are now able to place in the cutter body. This gives the cutters more life; it lasts longer; it requires more time and service to use up the stock in the body. Another advantage is the additional width of the cutting face. In other words, the increased cutting area enables the reamer to cut more of the circumference of the hole at each stroke of the tool. [406]

Q. 982. (By Mr. BLAKESLEE.) Let me interrupt the witness again. Read the question to him. (Question 980 read by the Examiner.) And I will ask the witness to confine the answer to the scope of the question. I will call the attention of the witness particularly to that part of the question which inquires into the functions of the extensions specified.

A. The function of the V-shaped grooves themselves is to enable the use of a wider cutter, give more bearing surface on the cutter and on the reamer body to resist the wear, and to make a stronger cutter and to make a reamer body which braces the cutter better. The grooves themselves are merely the result of shaping the body to do those things. So far as the grooves themselves are concerned, they have little or no functions.

(Testimony of E. C. Wilson.)

Q. 983. Now, with what do the surfaces consisting of the lateral extensions of the hollow slotted extension of the body of "Complainants' Exhibit Double Underreamer," which lateral extensions are produced in forming the V-shaped notches or dovetails at the bottom of the body, coact?

A. They coact with the bearings on the extended shoulders of the cutters.

Q. 984. What is the effect and result of such coaction of these lateral extensions and these lateral bearings on the cutters?

A. As I explained in a previous reply, they give more bearing surface to the backs of the cutters and to the spreading-bearing on the reamer body, and enable them to better withstand the strain applied thereto, and to more firmly brace the cutters to prevent the rotary motion previously referred to.

Q. 985. Does the coaction of these lateral extensions of the spreading-bearings or the lateral extensions produced by the formation of the V-shaped notches or dovetails at the bottom of the body of "Complainants' Exhibit Double Underreamer," with the lateral extensions or bearings upon the cutters, enter into and play a part in the actual expansion and contraction of the cutters to [407] and from the actual working condition of expansion?

A. Those parts are in contact and, in all probability, those portions of the reamer body and the cutters bear a certain portion of the strain or friction whilst the cutters are traveling for at least a portion of their stroke while being collapsed or expanded, and to that

(Testimony of E. C. Wilson.)

end may be said to play a part in the actual expansion and contraction of the cutters.

Q. 986. During the contact of these lateral bearings or extensions on the cutters of "Complainants' Exhibit Double Underreamer" with the lateral extensions of the same underreamer formed by producing the V-shaped notches at the lower end of the body, and during any period of the motion while such surfaces are in interengagement, is there any actual approach during the contraction or separation during the expansion of the lower or cutting edges of the cutters?

A. There is, due to the angular face of the dovetail grooves in which the cutters travel. The outer faces of those dovetail grooves incline upwardly and inwardly, and the moment the cutters are drawn downwardly the extreme lower ends of the cutters commence to move toward each other.

Q. 987. Is any such approach or separation of the lower or cutting edges of the cutters in that underreamer caused by the interengagement of such lateral extensions or bearings upon the cutters with the extensions on the body formed by producing such V-shaped notches or dovetails at the bottom of the body?

A. The motion that is obtained during the period of time that those points are in contact and while the cutters are moved either up or down, is produced by a combination of the bearing referred to and also by the bearings across the entire face of the bearing surface in the hollow slotted extension, and also with the

(Testimony of E. C. Wilson.)

motion produced by the angular face of the dovetail grooves in the body, and, therefore, the particular bearing faces referred to [408] may have something to do with the travel in or out of the cutting edges of the cutters during the period of time referred to.

Q. 988. The lateral extensions of the body formed by producing the V-shaped notches at the lower end of such body in "Complainants' Exhibit Double Underreamer," have parallel faces, have they not, or faces parallel with and a plane coincident with the longitudinal or vertical axis of the body, have they not? A. They have.

Q. 989. Now, as to the portions or surfaces of these lateral extensions which are beneath the said parallel faces of the lateral extensions formed by producing the V-shaped notches at the lower end of the body of "Complainants' Exhibit Double Underreamer," do the lateral extensions or shoulders upon the cutters of this exhibit coact in any respect with these lower inclined surfaces? A. They do not.

Q. 990. What in the cutters of "Complainant's Exhibit Double Underreamer" does coact with these synclinal or inclined surfaces at the lower end of the body?

A. The shoulder produced by the V-shaped groove planed across the back of the shank of the Double underreamer cutter, which shoulder projects upwardly and outwardly and is the shoulder furthest down or the one nearer the lower end of the cutter.

Q. 991. Do you find any parts of the cutters of

(Testimony of E. C. Wilson.)

“Defendant’s Exhibit Double Underreamer” or of the Double underreamer pictured and described in “Complainants’ Exhibit Double Underreamer Patent,” which are capable of coengaging with the lateral extensions at the lower end of the body of “Complainants’ Exhibit Double Underreamer,” formed by producing the V-shaped notches or dovetails, in a manner similar to the coengagement of such lateral extensions on the body with the lateral extensions or shoulders upon the cutters of “Complainants’ Exhibit Double Underreamer”? A. No, sir. [409]

Q. 992. Now, these same lateral extensions or shoulders upon the cutters of “Complainants’ Exhibit Double Underreamer” are present, are they not, in the cutters of “Defendants’ Exhibit Wilson Underreamer Patent”? A. They are.

Q. 993. Please state whether these lateral extensions upon the cutters of “Complainants’ Exhibit Double Underreamer” perform similar offices to those of the lateral extensions or shoulders of the cutters in “Defendant’s Exhibit Wilson Underreamer Patent”; and, if so, what such similar offices are.

A. They do perform similar services. The similarity consists in widening the body of the cutters, giving a greater cutting surface and more material in the cutter, giving longer life of the cutters; also in forming a point or position where the bearings can be placed at the extreme limits of the extension of these shoulders, which, as previously described, more firmly brace the cutter and transfer the point

(Testimony of E. C. Wilson.)

of contact to a place where the cutters are stronger and better able to resist the strain.

Q. 994. In "Complainants' Exhibit Double Underreamer Patent," or in "Defendant's Exhibit Double Underreamer," do you find any features of construction analogous to or like the lateral extensions produced to the periphery of the body of "Complainant's Exhibit Double Underreamer," at the lower end of the body, and formed by producing the V-shaped notches at the lower end of the body?

A. No, sir; there are no such features to be found on the device as shown by "Complainants' Exhibit Double Underreamer Patent" or by the device as shown by the "Defendant's Exhibit Double Underreamer."

Q. 995. In order to provide surfaces for these lateral extensions or shoulders of the cutters in "Complainants' Exhibit Double Underreamer Patent," that is, surfaces for coengagement of such shoulders, the V-shaped notching or notching of some sort of [410] the lower end of the body of the reamer to or toward the periphery of the body, was necessary, was it not?

A. A certain amount of the stock of the Double underreamer body had to be removed in order to do so; and it could have either been in the V-shaped groove or in a rectangular groove.

Q. 996. In other words, the cutters of "Complainants' Exhibit Double Underreamer" could not coact with the body of "Defendant's Exhibit Double Underreamer" or the body of the underreamer dis-

(Testimony of E. C. Wilson.)

closed in "Complainants' Exhibit Double Underreamer Patent," so as to provide for use of and take advantage of the lateral extensions or shoulders upon the cutters of "Complainants' Exhibit Double Underreamer Patent," without so altering and essentially changing the formation of the lower end of the body of the reamer, could they?

A. They could not.

Q. 997. And, I take it from your previous answers, and I ask you if I am correct in so taking it therefrom, that a material advantage gained in so altering the lower end of the body of the Double underreamer was to permit the bodies of the cutters themselves to bear upon or against the altered body of the underreamer so that there might be a strain-resisting back or reinforcement for the cutters at the bodies thereof and beneath the shanks thereof?

A. Yes, sir; that was one of the big advantages gained.

Q. 998. And providing the cutters of "Complainants' Exhibit Double Underreamer" with enlarged bodies, resulting from extending the bodies of the cutters laterally to form the shoulders thereon, produced cutter bodies having more stock for the same size reamer, than was provided in "Defendant's Exhibit Double Underreamer" or in an underreamer constructed in accordance with the disclosure of "Complainants' Exhibit Double Underreamer Patent"? Is that so? A. Yes.

Q. 999. And what, if any, advantage resulted therefrom?

(Testimony of E. C. Wilson.)

A. It increased the cutting surfaces, which enables [411] the cutter to ream or cut more of the circumference of the hole at each stroke, and also gave additional life of the cutter by reason of the added amount of material in the cutters, and also strengthened the cutter by increasing the amount of material in the body of the cutter itself.

Q. 1000. I take it that you would designate as a particular advantage attaching to the provision of lateral extensions or shoulders on the cutters, of "Complainants' Exhibit Double Underreamer," which you have said are the same as the lateral extensions or shoulders upon the cutters of "Defendant's Exhibit Wilson Underreamer Patent," and of producing the lateral extensions upon the body of the reamer by forming the V-shaped notches at the bottom of the body, consists in the effective bracing which results from the coaction of these shoulders with these lateral extensions upon the body, laterally of the shanks of the body? Am I correct in that?

A. Yes, sir; that is one of the chief advantages.

Q. 1001. As to "Defendant's Exhibit Wilson Underreamer Patent," the lateral extensions or shoulders, 4³, bear upon the surfaces, 9, on the prongs at the lower end of the body when the cutters are in expanded position, effectually bracing the cutters at the bodies thereof and laterally of the shanks of the cutters, do they not? A. They do.

Q. 1002. Then I take it from your previous testimony that the portions of the lateral extensions

(Testimony of E. C. Wilson.)

upon the body of "Complainants' Exhibit Double Underreamer" formed by the V-notching of the body at the lower end, with which portions the shoulders or lateral extensions upon the cutters of "Complainants' Exhibit Double Underreamer" coengage, serve in this bracing function similarly to the surfaces, 9, on the sides of the prongs of "Defendant's Exhibit Wilson Underreamer Patent"? Is that correct? [412]

A. Yes, sir.

Q. 1003. And, furthermore, the lateral extensions or shoulders upon the bodies of the cutters of "Complainants' Exhibit Double Underreamer" which coact with the lateral extensions upon the body of "Complainants' Exhibit Double Underreamer," formed by producing the V-shaped notches at the lower end of the body, act similarly in this bracing relation to the surfaces, 4³, of the cutters of "Defendant's Exhibit Wilson Underreamer Patent"? Is that correct? A. Yes, sir; they do.

Q. 1004. Previous to your manufacture of the reamers like "Complainant's Exhibit Wilson Underreamer," did you ever see an underreamer manufactured by the complainant company—the Union Tool Company—having the lateral shoulders or extensions upon the cutters and the coacting surfaces upon the body of the V-shaped notches, similar to "Complainants' Exhibit Double Underreamer"?

Mr. LYON.—Objected to as not cross-examination and as leading, incompetent, and not the best evi-

(Testimony of E. C. Wilson.)

dence, no foundation laid for the introduction of secondary evidence.

Mr. BLAKESLEE.—In connection with this objection the attention of the court is particularly called to questions 975 to 979, inclusive, and the answers thereto, of the direct examination of this witness in these proceedings on behalf of complainants; and particularly to question 979 and the answer thereto, such question being, “The underreamers referred to in this letter which has just been offered in evidence, Mr. Wilson, were of the type which is exemplified in this case as ‘Complainant’s Exhibit Double Underreamer,’ are they”? As to the objection on the ground that the question is leading, it is only to be remembered that this is a question on cross-examination.

A. No, sir.

Q. 1005. As to the manufacture of underreamers like “Complainants’ Exhibit Wilson Underreamer” by the defendant company, [413] such manufacture is under your consent as owner of the letters patent, “Defendant’s Exhibit Wilson Underreamer Patent,” is it not? A. It is.

Redirect Examination.

(By Mr. LYON.)

Q. 1006. Do the lateral extensions of the cutters or bits of “Complainant’s Exhibit Double Underreamer” perform the same or substantially the same functions as the lateral extensions of the Wilson underreamer?

A. They perform a portion of the same functions.

(Testimony of E. C. Wilson.)

Q. 1007. Are the functions substantially the same?

A. A portion of the functions which they perform are substantially the same.

Q. 1008. What portion?

A. They brace the cutters against the rotary motion which I have previously described; their very existence widens the body of the cutter, which gives more cutting surface to the cutter, increasing the strength of the cutter, gives more material in the cutter and, consequently, a longer life.

Q. 1009. In their mechanical co-operation with the coating surfaces on the body of the underreamers, do the lateral extensions to which you have referred on the cutters or bodies of "Complainants' Exhibit Double Underreamer" perform the same or substantially the same functions as the lateral extensions of the bodies of the Wilson underreamer?

Mr. BLAKESLEE.—This question and the three preceding questions are objected to as leading.

A. I will repeat that they perform a portion of the same functions.

Q. 1010. Those are the functions which you have referred to in the previous answer? [414]

A. Yes, sir; those are among them.

Q. 1011. Any others?

A. Yes, sir; by that form of construction the strains on the cutter are better resisted and makes a stronger cutter and gives more bearing surface on the cutter itself and on the body and, consequently, better enables the reamer to resist the wear.

Q. 1012. Do they perform the same or substan-

(Testimony of E. C. Wilson.)

tially the same functions in the collapsing and contracting of the bodies?

Mr. BLAKESLEE.—The same objection.

A. To a certain degree; yes, sir.

Q. 1013. The difference is one of degree, then?

A. There is a difference, but it is one of degree, I should say. There is a difference.

Mr. BLAKESLEE.—Let the record show that at the request of counsel for complainant, without explanation to counsel for defendant, the Special Examiner left the room in which these proceedings are being conducted, leaving the witness upon the stand, and, without taking any adjournment, and was so absent from the room for over two minutes by the watch. This proceeding is objected to as irregular and having no warrant under the rules or under the terms of the special reference made to the Examiner in this case.

Mr. LYON.—The Special Examiner will certify on the record at this point what was done outside.

And the Examiner here certifies that by request of Mr. Lyon he retired from the room and read to him Question No. 987, propounded to this witness, and the answer thereto, which question or a portion thereof and the answer thereto were typewritten by Mr. Lyon.

Recross-examination.

(By Mr. BLAKESLEE.)

Q. 1014. Now, as to any analogy between the action of the cutters of "Complainants' Exhibit Double Underreamer" and the cutters [415] of the

(Testimony of E. C. Wilson.)

underreamer of "Defendant's Exhibit Wilson Underreamer Patent," in the expanding and contraction actions, have you anything further to add to your testimony given in cross-examination with respect to the coengagement of the lateral extensions or shoulders of the cutters with the lateral extensions upon the body formed by V-notching the body in "Complainants' Exhibit Double Underreamer"?

A. So far as the general forms of construction are concerned, the Double underreamer cutter as shown by "Complainants' Exhibit," lacks only one thing to make it almost identical with the Wilson underreamer cutter and that is the omission of the V-groove across the back of the shank of the cutter. Otherwise the cutters are about the same.

Q. 1015. My question, Mr. Wilson, was not with respect to the construction of the cutter on "Complainants' Exhibit Double Underreamer" taken by itself, but with respect to the contraction and expansion action and the participation in the same of the lateral extensions or shoulders upon the cutters of "Complainants' Exhibit Double Underreamer" with the lateral extensions upon the body of "Complainants' Exhibit Double Underreamer" formed by V-notching the body at the bottom. As to this participation and strictly in the contracting and expanding actions, have you anything further to add to your previous testimony on cross-examination, completed this morning, qualifying or explaining such participation of such parts and surfaces in such

(Testimony of E. C. Wilson.)

contracting and expanding actions?

A. Inasmuch as those parts are in contact with each other during a portion of the contraction and expansion action of the cutters, they unquestionably perform in a measure the same functions that the bearings at the back of the shoulders of the Wilson underreamer cutter perform when riding on the spreading-bearings of the Wilson underreamer body.

Q. 1016. But those spreading-bearings on the Wilson underreamer body are inclined bearings, are they not, giving by coaction [416] with the shoulders an actual expanding or contracting effect at those points and through those agencies, do they not?

Mr. LYON.—Objected to as leading and suggestive.

A. Yes, sir; the spreading-bearings of the Wilson underreamer body are not parallel. They are tapered downwardly and inwardly, and a downward play of the cutters causes them to swing inwardly at the cutting edges; in other words, to commence to collapse on the first of their travel downward. A similar thing results in the Double underreamer but it is produced in a slightly different way.

Q. 1017. (By Mr. BLAKESLEE.) What do you mean? In "Complainants' Exhibit Double Underreamer"?

A. In both "Complainants' Exhibit Double Underreamer" and in the original Double underreamer exhibited by the patent in suit.

Q. 1018. But I am only referring to such under-

(Testimony of E. C. Wilson.)

reamer as has the lateral extensions or bearings upon the cutters and the corresponding surfaces on the body. Those are not present in the patent Double underreamer construction, are they?

A. They are not.

Q. 1019. Now, you have testified that a number of factors enter into the expanding and contracting actions in "Complainants' Exhibit Double Underreamer." Were none of those features present, save and except the lateral extensions or shoulders upon the cutters and the parallel flat faces of the lateral extensions on the body formed by V-notching the body at the sides at the lower end thereof, would such lateral extensions or shoulders on the cutters and the coengaging parallel extended surfaces upon the body in themselves cause expanding or contracting action?

A. No, sir; not while the faces of the extended lateral faces of the hollow slotted extensions and the faces in the backs of the extended shoulders or bodies of the cutter are in contact. [417]

**Testimony of John E. Sanford, Called as a Witness
on Behalf of Complainants in Rebuttal.**

Mr. Sanford testifies as follows:

I am 53 years of age; resident of Coalinga, California; occupation, driller. Have been in the oil business since 1884; I have used two kinds of underreamers, namely, the Austrian underreamer and the Double. Used the Double reamer in about 1901. I secured the first Double underreamer from the Union

(Testimony of John E. Sanford.)

Tool Company's shop at Santa Paula. Since using the Double underreamer in 1901, I have never used any other style of an underreamer. My reason for never using any other reamer is I never had any as good as the Double. I am using the Double improved type. Comparing the Double improved type with the first Double I used about 1901 as to strength and durability and efficiency I say I never saw a great deal of difference in them. I am acquainted with Mel. Kellerman, yes, sir.

I have knowledge of the use of a reamer by Mr. Kellerman, one of his own production; it was in the Los Angeles field, in the Cottage Home tract. It seems as though pretty near every time they ran it into the hole to ream they had to pull the casing to get it out. I wouldn't call it a practical or successful underreamer, from what I saw of it at that time. I had nothing to do with it personally. My knowledge of them is wholly from the drillers that were working with them.

I had ^{*}nothing to do personally with the Kellerman reamer. I did not personally see the Kellerman reamer put into the hole. No, I never saw the Kellerman underreamer in use. I just saw them at the Baker Iron Works when they were building them. All I know about the use of the Kellerman reamer is what the drillers told me.

The Austrian underreamers would ream so that you could lower the casing if you didn't have a very hard shell. I didn't have very good experience with them. They were too weak. They wouldn't [418]

(Testimony of John E. Sanford.)

stand anything. They were too lightly constructed. No, you can't ream any faster with a new style Double than you can with the old style. I have never made any comparison though.

I have not seen any of the old style Double underreamers used in the last two or three years. I really haven't any preference between the original or old style Double and the improved.

**Testimony of Fred L. Fish, Called as a Witness on
Behalf of Complainants in Rebuttal.**

Mr. Fish testifies as follows:

My name is Fred L. Fish; occupation, driller. I live in Coalinga, California. I am acquainted with Thomas O'Donnell. I have worked for him, both in Los Angeles and Coalinga. I drilled for him at San Fernando at what is called the Alliance Oil Well. Tom O'Donnell sent an underreamer up there. I saw Arthur Willard at that well. I put the O'Donnell underreamer on and reamed a screw with it, that is, just about three or four feet. I mean the length of a temper screw. Then I was about four hours getting it out of the hole. It stuck all the way down the casing. To tell the truth about it, it wasn't any good on earth for underreaming a well. I think the time I refer to was the only time it was used on that well. After I got it out it was thrown off and I don't think it was ever used again on that hole.

I don't know what Willard did do with the underreamer while he was at the Alliance Well.

Q. 19. Do you know what Arthur Willard did at the Alliance Well when he came there?

(Testimony of Fred L. Fish.)

A. He fixed that or else fooled around it. I don't know what he did do to it. But it wasn't used after that. I know that—on that hole. I did not see the 7 $\frac{5}{8}$ " O'Donnell & Willard reamer. I am using a Double reamer at present. I never had any trouble with the old style Double reamers. I prefer the new [419] Double reamer to the old one. The O'Donnell & Willard reamer did its work so far as we went with it. A screw, that is all I underreamed. The formation was not hard.

Q. 36. What kind of formation?

A. It was a kind of sandy conglomerate, but it was not very awful hard, though.

Q. 37. Are you sure it was not limestone or granite?

A. No, sir; it was not limestone. It was a kind of a hardish sandstone.

The trouble we had with the O'Donnell & Willard reamer was getting it back to the casing. The trouble was the block or collar would pack with sand, causing the cutters to stick. I didn't pay a great deal of attention to the reamer. I don't know exactly what happened to the reamer only it gave us trouble in the hole. I have had trouble with Double reamers sticking in the shoe and casing.

The O'Donnell & Willard reamer was so constructed that it had two cutters operating over a wedge or partition between them and was raised or lowered by a spring. The reamer body was formed at the bottom to fit around the shanks of the cutters in such a manner that the cutters were caused to

(Testimony of Fred L. Fish.)

expand when they were drawn up by the action of the wedge between them.

The sleeve or collar on the outside of the O'Donnell & Willard underreamer body did not have to be on there anyway. It was all folly that it was on there.

Yes, I have tied Double underreamer cutters together lots of times in order to get the reamer down the casing. There was no other reamer used in the hole at San Fernando.

I have used the Swan underreamer and several other kinds of underreamers. I have used the Austrian underreamer. Mr. Willard was not there when the reamer was used nor was Mr. O'Donnell there when the reamer was used in the San Fernando well. There wasn't anybody there only me and my tool dresser. Mr. Lehman was not there [420] when the reamer was used. I never saw Mr. Lehman use the reamer on that well. The trouble with the O'Donnell & Willard reamer was the cutters were too wide. It did not leave room enough for the cuttings to come around at the sides of the cutters. I continued to work for Tom O'Donnell after leaving that well but never saw that 9 $\frac{5}{8}$ " reamer again. After I got this reamer out of the hole I have been talking with Mr. O'Donnell quite a little over it and I told him it was no earthly good.

**Testimony of R. E. Gray, Called as Witness on
Behalf of Complainants in Rebuttal.**

Mr. Gray testifies as follows:

My age is 42; occupation, driller; residence, Coalinga. Have drilled in the Newhall field. That

(Testimony of R. E. Gray.)

was in 1901 or '02. We used the Double reamer. Prior to that we used the old Austrian reamer. It was never any good, never had any success with it.

I never heard of the O'Donnell underreamer at the Alliance Well. The opportunity I had would be from hearing the other drillers talk about it. The same custom prevailed then as now. We get together and we will mention certain tools and new tools especially. We always mention them. I have not found any difference in the amount of underreaming I could do with the Double improved and the Double of 1902, nor in the making of hole. I never heard of that underreamer being used in the Newhall well. I had success with the Double reamer. The Wilson is not as strong a reamer as the Double. I don't like its action. The spring or mandrel does not hold the cutters like on the Double reamer, and I don't class in my opinion the Wilson reamer as being anything like as good as the Double reamer is for all around purposes. The Wilson reamer is not as strong as the old style Double reamer. I think the weak point of the Wilson reamer * * * very weak, is in [421] those two little set-screws in the body of it, which hold the mandrel which carries the cutters. When running it I found those would be bent when I would go to take them out and dress the cutters and change the cutters. Now that, excepting a little cross bolt in the bottom of the reamer below the mandrel is the only thing that I can see that the reamer has to hold the cutters in action. If those break, or even if the spring breaks, you have

(Testimony of R. E. Gray.)

nothing but that little bolt below and you leave the cutters in the well. The experience that I have had is that you break this bolt and leave the mandrel cutters and all in the hole. I have left the cutters, spring and mandrel in the hole. The bottom of the Wilson reamer where the cutters go in is cut straight through, and sides just leave a narrow bearing for your cutter. It don't have the full surface bearing at the bottom of the cutters the same as the Double. I have always claimed and do to-day that it makes it a weaker reamer than the Double. In reaming in bouldery stuff and the like, you will come onto boulders and they will drive in there, and the conditions of the sides projecting down will allow the boulders often to wedge there and break the bottom bolt. I have had that happen with them and not be able to get them out of the bottom. Whereas, with the Double reamer the bottom is solid and comes down clear through and prevents it from doing so. I never broke any Wilson cutters though. I never noticed any spread of Wilson underreamers at the prongs, nor did I ever bend or break any of those portions. Comparing the prongs and mode of action of the cutters in expansion and contraction in the Wilson and in the old style Double reamer with each other, they compare I think the same. That is my opinion of it. The comparison of the two that way are on the same principle. The old style Double cutter is straight and smooth on the inner face just the same as the Wilson,—I mean the inner face of the cutter is straight and smooth.

(Testimony of R. E. Gray.)

Q. 45. Now, the Wilson cutters have extensions at the sides [422] at the cutting ends, have they not, which engage with the edges of the prongs to cause the contraction and expansion of the cutters?

A. I don't think they have.

Q. 46. Well, then, please explain what causes the expansion of the cutters in the Wilson reamer.

A. It is a hard question for me to explain. It has been about three years since I have used the Wilson reamer. It was in the Maricopa field that I used it when I worked there for W. Snook in the New Center Oil Company. To get the real right idea of what you call expansion and contraction, I have got to use my own language as we do around the rigs: That that must be by pulling the cutters down to get them to go in the hole is your contraction. And when they get into the bottom of the pipe ready for work, that is your expansion.

Q. 47. When they get below the bottom of the pipe?

A. Now, will you please read the question the gentleman asked? (Question is read.) That is caused simply by the cutter being made to fit the groove of the reamer—the stock of the reamer—which the principle is right with the type of the old Double reamer. As the spring pulls it up, it sets it out to its expansion.

Q. 48. Then I am to understand, am I, that it is the movement of the Wilson cutters in those grooves which causes the expansion of the cutters?

(Testimony of R. E. Gray.)

A. Yes, as far as I understand your question, that is what I think.

Q. 49. Is there anything in the space in the body at the lower end between the cutters in the Wilson reamer that assists in the expansion of the cutters?

A. I wish you would bring the reamers here and let me see them, and then I can show you and explain to you and understand your meaning very plainly and distinctly then. [423]

Q. 50. Well, I want you to testify from recollection in answering these questions just as you have in answering those propounded by Mr. Lyon. You have testified that the cutters in the Wilson underreamer expand and contract in substantially the same manner as in the Double underreamer. Now, perhaps, you had better tell me in support of that statement just how the Wilson cutters expand and contract.

A. That means for a man to take in to explain to you—would mean for me to take in as much of the reamer as possible for to make anything plain so that you would understand it. In the first place, I have told you it has been about three years since I have used the Wilson reamer—over three—and every day I am in contact with the Double reamer, using it for the company that I am working with. It is much clearer that I could understand that reamer and explain it to you than one that it has been a number of years since I have used it. I did not use the reamer a great while then. Now, that reamer, you see, as you say, it has a slot on the side there that it works

(Testimony of R. E. Gray.)

in, and to pull that reamer down we use a bar to contract that reamer. We pinched them down with the bar and then we would use a block in here on top of the cutter and get the block to hold it till we get it inside of the casing. The cutter, you would bear in mind, would be in the bottom, and we would take the bar to pry in and pull that block out, and you say it works on a slot. That is my recollection of the reamer, and it made it disagreeable in that respect. There was two hooks came along with those reamers. There was a hole in the cutters that you could pull them down in. We never used it. We always barred it down and put it in the hole that way. That is the way we contracted the reamer and the springs, I guess, for the expansion of it when it goes into the hole. That is the only thing that can expand the reamer.

I have broken Double underreamer cutters, yes, sir. I have broken 3. It was on a small reamer. [424]

Q. 57. How many breaks of that kind have you had?

A. I have had three to my personal knowledge. It was on a small reamer.

Q. 58. What became of the cutters?

A. They broke—I never left but one in the hole. I got one out. I left the cutter in the hole.

Q. 59. How did you get them out?

A. We drilled them out.

Q. 60. How did you get them out?

A. I never fished for them. It was in a $6\frac{1}{4}$ hole

(Testimony of R. E. Gray.)

and we never tried to fish them out. We left them there.

There was some reaming done with Austrian reamers, yes, sir. If I was getting a reamer for myself I would rather have the old style Double reamer than the new because the cutters are stronger. I have had trouble to get Double underreamer cutters out of the hole and I have tied Double cutters together to get them down into the hole. I consider the sub or middle joint in Double reamers a great advantage. My experience with the Double reamer has been that I never broke one of them on a large sized reamer, and I have used them constantly for four years, steady and had one in the derrick all the time from 15-1.2 inch down to 4½. The custom of tying cutters applies equally to the Wilson reamer. I have never had any trouble with the "sub" or joint between the sub and main body of the Double reamer. That joint is stronger than any other joint in the string of tools that you are running. There is no danger in it. It is a big joint and you see what advantage it gives you. It is an advantage to open a joint for a string of tools. It does not weaken the joint. The oftener you open a joint and spring it up and set it up the better the joint is.

Q. 105. The oftener you set it up—

A. Yes, sir; you take a new joint and first start running it, there is rarely one of them that is a good joint. When [425] you break your joint, the oftener you do it and work it, until you overdo it—the oftener you break a joint the more you improve it in its sticking capacity.

**Testimony of Geo. D. Roberts, for Complainants, in
Rebuttal.**

Mr. Roberts testifies as follows:

I am a resident of Coalinga, my occupation is oil driller and I am 52 years of age. I am familiar with underreamers and have used them, yes, sir. I am at present connected with the Stockholders Oil Company. I am president and owner of that company. I am president of the United Development Company of Coalinga and one of the directors of the Little Sespe Oil Company on the little Sespe in Ventura County. Those companies use Double underreamers. We have broken one Double underreamer bit and other portions of Double underreamers. I didn't break the cutter—it was broken under my management. That was a lug we broke within the last three years and I haven't any of the old style Double underreamers. My idea of the V-shaped groove is that it prevents the cutters from spreading apart.

I had a debate recently with one of my men. I decided for myself that the old style Double underreamer was a stronger underreamer than the one they are making at present. That argument arose over the fact that that lug broke diagonally across that way to the slot where the key goes through the mandrel part. I don't think there is quite as much stock in that as there was in the old.

I don't think the cutters have as much stock in them as the old style cutters used to have at that point. We are doing all work faster than we used

(Testimony of Geo. D. Roberts.)

to, but I cannot say that we could attribute that to the difference in the style of underreamers. That is, from the old to the present. We have heavier joints and heavier tools and such things as that, and we give them a little more motion and rap it to them harder and make hole a little [426] faster to-day than we did before. When we first used Double underreamers we had calf wheels. I cannot see that calf wheels are of any assistance when underreaming. Of course it enables you to spud the pipe and assists in underreaming to that extent. I have used the National underreamer and have also used the Austrian underreamer. We had very little underreaming to do with the Austrian but we got along with it. Yes, sir, the Austrian underreamer worked. We had very light tools then and very little underreaming to do. In fact, since the new underreamer came out—the Double and the Wilson—I wondered how we ever got them into the hole or what we have put them in for at all. It was a kind of a makeshift arrangement in my opinion. We have never used Wilson underreamers on our lease. We have five Double reamers of various sizes on our lease now.

**Testimony of Henry Towery, Called as Witness on
Behalf of Complainants, in Rebuttal.**

Mr. Towery testifies as follows:

I am an oil well driller and am now drilling on the Baltimore Oil Company's property, in the Midway Field near Taft. I reside near the town of Taft, California. Have been in the drilling business

(Testimony of Henry Towery.)

since 1900. I have used four kinds of underreamers in the California Field, the Plotts underreamer, the Austrian underreamer, the Double underreamer and the Wilson underreamer. Believe I have used the Double reamer the most. First used the Double in 1902 or '03 in the Santa Maria Field. It gave very good results. It was far superior to the Austrian or Plotts reamers. We used the Wilson reamer in 1905 or '06. It gave considerable trouble to remove the cutters to dress them. I have broken a mandrel and lost a set of cutters or knives of the Wilson reamer. I have lost several of the retaining bolts from the bottom of the Wilson reamer. It didn't [427] amount to much—it did not cause us a great deal of trouble. I broke the mandrel of the Wilson underreamer on Section 25 and lost both cutters in the hole. Mr. W. L. Clay was the superintendent. We had fishing tools made to try to fish them out but had to drive them into the side of the well.

The Plotts and Austrian reamers never were successful. I never could do very much with them. Of course, at that time we did manage to ream with them so as to get the pipe through, that is in some places. Never saw any more Plotts or Austrian underreamers used after the Double reamer came out. The Double reamer was universally used up to the time the Wilson reamer was put on the market. You can drill farther with the Double underreamers than with the Austrian. The introduction of the Double reamer enabled us to drill

(Testimony of Henry Towery.)

with better success. We could get in longer strings of pipe in the hole, been able to carry longer strings of pipe through more difficult formations—harder. The cause of shallow hole in well drilling is because you have to reduce the size of your casing very quickly. That is on some occasions.

I consider that the calf wheel and the steel rope were also necessary in order to drill deep wells. I would not attempt to drill a deep hole to-day unless I had a heavy casing and proper means for handling it. The mandrel or tee of the Wilson underreamer which I broke on Section 25 Hill was broken in the year of 1907 or '08. I was reaming a hard shell.

I have broken one Double underreamer cutter, yes, sir.

I have used both styles of Double underreamers and prefer the last reamer or their improved type. The cutters are better supported and gives them more strength. They are held in the bowl more firmly. We are using Wilson reamers on the lease where I am at present. Do not know whether they have Doubles or not. The only reamers I know of on that lease are Wilson reamers. I have no particular preference between Double and Wilson reamers. [428]

I prefer the improved Double to the old Double because of the dovetail at the bottom—the V-slot.

**Testimony of A. P. Kennedy, Called on Behalf of
Complainants, in Rebuttal.**

Mr. Kennedy testifies as follows:

I am engaged in the oil well drilling business and have been since the '80's. I am field manager for the Brookshire Oil Company on Section 24. That is located near Fellows. I have used Wilson underreamers a little and have used the Double. I have also used the North reamer twelve years ago in April. The North was used on the Pathis Sola Oil Company in the foothills of Whittier. It was a 4½" reamer and we had a two-foot shell. It went through that shell all right. That was all the work we had for it to do. It practically didn't amount to anything. I wouldn't consider the North reamer strong enough to do the amount of work. Where the key goes through the cutters they were too light. We had no trouble in running the North reamer in or out of the casing. No trouble in running it either way. I never tried it except for this two feet. After using this North, I next used the Double and have been using it ever since, except once that I ran the Wilson reamer. I prefer the Double reamer.

The Wilson reamer I used lost the cutter. That was on the Miosa Ranch in San Luis Obispo County. That was six years ago last May I lost the cutter off. The T-bolt pulled down and bent over. That is the reason I didn't like it. I broke one cutter off the Double underreamer. It was occasioned by a crooked hole. I have never found any difference

(Testimony of A. P. Kennedy.)

in time in reaming with the old style Double or the new style, because I never was after making time. The idea was to get the reaming done so that the pipe would follow without any trouble. The casing followed where I done the [429] work because I took time enough to underream. If there was any bolt in the Wilson reamer across the mouth, the reamer from which I lost the cutters, I don't remember it.

The North reamer was the one reamer we used on the Pathis Sola well at Whittier. It did all the reaming that was done on that well while I was there. I don't think they ever had it in the hole any more if I recollect right. We had no trouble with it at all.

**Testimony of John Shupe, Called as Witness on
Behalf of Complainants, in Rebuttal.**

Mr. Shupe testifies as follows:

My name is John Shupe; occupation, well driller. Have been drilling in California for about ten years. Have worked in the Salt Lake fields of Los Angeles. Have used underreamers. I tried the Wilson underreamer there one day. I don't remember very much about it. We only tried it a couple of hours and then we pulled it out and could not get the lugs out. We could not get the bolts out and we threw it out and that is all of my experience with the Wilson underreamer. After that we used Double reamers. I left the Salt Lake Company in about 1907 or '08 and went with the American Petroleum Company, and we are working near

(Testimony of John Shupe.)

Sherman Junction. We use the Double underreamer. I left there in about 1909. Went to Maricopa for the Wellman Oil Company. Used the Double reamers there. I don't see that there is any difference in the old style and new style Double reamers in the speed of reaming.

Q. 19. Comparatively in drilling what difference, if any, do you find in these two styles of Double underreamers? A. In the speed of reaming?

Q. 20. Yes.

A. I don't see that there is any difference.

Q. 21. Is there any material difference in the strength of [430] these two styles of reamers?

A. Well, in one way there is and in one way there isn't. That bevel they have on the lug that fits on the body of the reamer, in case you get on a boulder or anything, it can't spread the lugs. I think that has been an improvement on the reamer.

Q. 22. You refer to the V-shaped slot at the bottom of the new style Double reamer?

A. Yes, sir.

Mr. BLAKESLEE.—Objected to as leading, the witness having talked about features on the cutters.

Q. 23. (By Mr. LYON.) What part does this bevel on the lug that fits on the body fit on to the body, Mr. Shupe? Explain that a little more fully for us.

Q. Well, the V-shape in the body, of course, the lug is cut the same to fit into that V-shape, although the thrust of the reamer does not come on that V-shape at all. As I understand, it is not made for

(Testimony of John Shupe.)

that purpose, but to keep the lugs from spreading in case you should get muddled up or get something in and prevent them from spreading, either on the body or on the lugs.

Q. 24. And otherwise than this feature do you find any difference in the strength of the so-called old style and new style Double underreamer?

A. I should think the old style was a little the strongest, if anything.

If you get a corner thrust it will not break off as quick as the new style would. A blow on the corner tends to twist the cutters. The wider cutters on the Double improved type and wider spreading surfaces at the back would in my opinion better brace the cutters from twisting when such a blow on the cutters would occur. Of course there is more cutting surface on the new or broader type of cutter. I think the wide cutter is a disadvantage as it would have a tendency to break the cutter. [431]

A. Well, for the simple reason that in reaming it makes the cutter that much wider, and by hitting it on the point your reamer does not turn the full width of the cutter every time. If it only hits an inch or a half an inch on one corner, the cutter being that much wider, has—I don't know hardly how to explain that. It would have more of a tendency to break the lug, I should think. We are using only the new style Double underreamers. I would just as soon have the old style Double reamer as the "Improved." I don't know why the bolts or screws stuck in the Wilson reamer. I don't remember.

(Testimony of John Shupe.)

The Wilson reamer did not stick in the hole, no. The bolts or screws stuck in the reamer body so that we could not remove the cutters. That was the only trouble we had with the Wilson reamer that I remember of. We never tried it after that.

After this Wilson reamer gave us this trouble in the Salt Lake Field, we used the Double reamer as long as I was there,—with the Salt Lake or Amalgamated companies. I was there about four years. I have nothing to do with the purchasing of the tools for the company I am now with.

**Testimony of James Jackson, Called as Witness on
Behalf of Complainants, in Rebuttal.**

Mr. Jackson testifies as follows:

My name is James Jackson. I reside in Hazelton, Kern County, California. I am a driller by occupation. Am not in that business at present. I went into the oil business in 1876 and I have been drilling for the last eighteen years. I have used underreamers principally. Have used Wilson reamers a little and have used the North reamer a little. I used the North reamer in the Santa Maria field in a well known as the Newhall well. W. O. Maxwell was superintendent there. Think it was in about 1905. We put the reamer in the hole; I believe I put the reamer in the hole myself. I ran the reamer that morning. I cautioned the man to ream slowly [432] with the reamer and he pulled it out in the afternoon and the cross-bar was bent. I ran it again and when I pulled it out it looked to me as though it was unsafe. We had the tee bar

(Testimony of James Jackson.)

straightened out at the Union Oil Company's shop at Orcutt. We ran it again. I broke one lug off and the reamer stuck in the casing and we had to remove the casing in order to get it out. After that we got a Double underreamer. I would not be willing to run a North reamer in a well hole again. Have never seen a North reamer since that time. It was not a practical reamer in my estimation.

I have *tied* both Double and Wilson cutters in running in the hole. I have never used the old style Double but very little after the new style came in. The new style Double is the strongest reamer. The V-shaped grooves brace the cutters better. Don't find much difference in the spread of the two reamers. If you underream with the loose string of tools you are more apt to Keyseat the hole. The idea that a driller on the surface can turn the tools by twisting the rope is an old exploded theory. There is no definite control of the string and the tools. The only safe thing to do is to run with the tight string of tools, a tight line and the tools are bound to turn. There are men who will ream three feet to my one but I always make it a point to ream the hole thoroughly so that the casing will go down. I never broke off a set of lugs yet and I have run the Double reamer quite a bit and I have run all sizes from 13½" to 6"

In drilling a man will make twenty-five feet or thirty feet and then put in the reamer and enlarge the hole. That gives a chance to clean out the bottom. He then can ream only twenty-five feet or

(Testimony of James Jackson.)

so, enough for a joint. A sticky formation is apt to "ball up" the reamer. The underreamer shown in circular marked "Defendant's Exhibit Union Oil Tool Company's Circular of North Improved Underreamer" is, I believe, the North reamer I used, under W. O. [433] Maxwell in the Santa Maria field.

I prefer the new style Double reamer to their old style. The broad cutters are an advantage as it cuts the bigger surface. It gives more metal also to the cutters. The cutters will last longer. Well, the only difference in my estimation is that a man could ream faster and safer with the new style than with the old, and it would stand more punishment. The V-shaped slots interlock the cutter and the body and better braces the cutters. With the broader cutter you might not ream the hole any faster but you would be sure of reaming a better hole. There would not be so much danger of key-seating with the broad cutters, but at the same time, a man will key-seat with them if he runs loose enough. It is a question altogether of how a man runs, in my estimation. I think it is an advantage to the new style double reamer to have the side extensions on the cutters back up against the surfaces on the body below those dovetailed grooves, and brace them. The cutter is braced on its inner face, braced on the side extensions of the double reamer body, is stronger and is an improvement, yes. They are braced on those flat surfaces on the body of the Double improved reamer which are machined flat beneath the dovetailed grooves.

**Testimony of W. G. Henage, Witness Called on
Behalf of Complainants in Rebuttal.**

Mr. Henage testifies as follows:

I reside in Maricopa. Age about 58. Am an oil well driller by occupation. Have been in the oil business since the eighties. I have used underreamers. The first reamer I used was an Austrian underreamer. If we would strike something hard we would either break off the dogs at the hole where the pin goes through or we would bend the pins. If the pins were bent the reamer would not be serviceable. As a practical tool to run a stem on, as we do nowadays, they wouldn't stand it at all. You couldn't ream with [434] them because you would break them the first time you got on anything that was hard enough to ream. It would either break or bend the cutters. I am acquainted with Tom O'Donnell. Have been on the property he was operating. Have seen him drilling. I never heard anything about an underreamer which O'Donnell is supposed to have had in Los Angeles. Had there been one there I certainly would have seen it. We never used an underreamer there because we had never any occasion to in the field, near the city of Los Angeles. While in Ventura we used an underreamer known as the Day underreamer. I think we secured it from Joe Austin. It was called the Day & Austin or Eastwood reamer. He was the manufacturer of drilling tools at that time, in San Francisco. The lugs or cutters were about three feet long and there was a mandrel inside of it and passed through it which

(Testimony of W. G. Henage.)

had a spring on and a block at the end of the mandrel. The spring was opened and exposed. We used it on a well about 400 feet. That was the amount of work it done. It was not satisfactory to us nor to any of the companies. We could not ream. It took us so long to ream that we naturally wore it out. It would drive and stick when you put any weight on it, and the stems used in those days were about 3½ inches in diameter and 18 and 20 feet long. That would be a very light stem. We succeeded in finishing the well in which we used this Day reamer. Well, we wore it down and reamed it with this reamer, what we could. We had several breaks on it. One thing that would break frequently was the spring. This was due to the reamer sticking and the tools working would strike the block up against the spring and get the cutters sticking in the hole. Naturally, when you would ream the hole, and it was sand rock there mostly, the cutters would dive down in it. They were narrow and the cutting surface was small on them and they would dive ahead, and as the tools came up, it would contract the spring and the spring would become crystallized and all broke to pieces. We finished that well with it and then it was thrown out and then we drilled three more wells in that vicinity, but we never used it afterwards because we considered it [435] a failure as far as a tool was concerned. We drove the pipe afterwards on those other wells. Those lugs would bend sometimes. They would come out twisted around * * * bent, * * and there was den-

(Testimony of W. G. Henage.)

ger of leaving it in the hole, and it took so long to underream with it that the company concluded they would not use it any more and threw it out. Defendant's exhibit small working model of Day device looks something as I remember the Day underreamer looked.

Sometimes in taking it out of the well these lugs were twisted around and in diving you see it would come together there and spring out here. That is the weak end of it, and you can't make it strong, because if you would make it strong it would be so stiff that it would not ride down in the casing. The spring would break frequently. Based on our experience with this Day underreamer, I would call it impractical as an underreamer.

The next reamer we used was the Austrian underreamer. The Austrian underreamer will underream but it would not be practical if a man would figure on doing work or had to do a certain amount of work in the practical way as we do at the present time. It was the best that we had in those days, but a mere makeshift. After the Austrian underreamer we used the Double reamer. There has been a demand for underreamers since they commenced to develop oil in California. The first reamer I used was the Lane reamer and that was about 1888. They were drilling a well for the Government at Vallejo or Mare Island. If I recollect we bought it of the Saint Louis Vise and Tool Company.

A. Well, it wouldn't stand no hard work. The lugs of that reamer was so long—they were about five

(Testimony of W. G. Henage.)

feet long—and they had to be that length in order to be springy enough—and the consequence was when you put the tools on heavy enough the lugs would give way, and those lugs were bent to the body of the reamer, and that wouldn't work. In a short time the bolts and the other lugs would break when you put too much weight on them. They had to be long to get spring enough to get them in and out of the pipe. [436]

Asked when it was that he first got a practical underreamer in California, and what that reamer was, the witness answered: I believe the first I used was in 1903 and '4. It was the Double reamer. The Double is the only reamer I have used since then.

(Asked as to which of the types of the Double reamer the witness prefers, witness answers:) Well, I couldn't tell you the difference in them. I can't tell you the difference between the reamer that I used in 1903 and '4 from the present underreamer. I don't know as I ever noticed any especial difference.

We did considerable reaming with the Austrian reamer. We lowered the casing.

I think the Day reamer would stand more than the Austrian.

Q. 64. Didn't you find that the provision of shoulders on the body of the Day reamer to take the up-thrust or end-thrust of the cutters was an advantage over the way the dogs of the Austrian reamer were mounted and worked?

A. This reamer here, you understand, in reaming a hole that is drilled before it, the pressure is against

(Testimony of W. G. Henage.)

the side. Now, when that comes down in and presses in, it will pull that dog out—pull this part out here—and when you spring it together you throw it out here. And when the hole is open ahead and you are cutting a rock there, whatever you drive in there—it has a tendency to come into the center of the hole where it would get the hard surface, and consequently cause that to stick. There is no support here to these dogs to keep them from springing in.

Q. 65. The pressure, then, in reaming is in on the dogs?

A. Yes; to a great extent it is inward. It is inward, yes.

The cutters of the Day reamer are almost vertical when in reaming position. I would not prefer the Day reamer to the Austrian reamer, because it is a dangerous tool because of this being open, and I know in hard rock it will stick. There is nothing to this spring, and it works like a jack-knife. (Witness illustrates by taking model of Day device in his hands and working [437] the bits or cutters up and down). I would rather have the Austrian reamer to work with. I think the vertical position of the cutters is the best. The cutters of the Double and the Day work on end, hence there is a breaking strain on the Austrian which they do not have, as the Austrian cutters work extending at right angles; the bend is sideways on them.

Q. 85. Then, in that respect do you not consider that the arrangement of the cutters in the Double and the Day is preferable to the arrangement of the

(Testimony of W. G. Henage.)

cutters in the Austrian? I am asking now only as to that one respect.

A. The arrangements of the Double, I think, are very good, because they have a protection so that they stay in place and take the thrust, while this has no protection whatever. (Witness, in giving this last portion of his answer, picks up "Defendant's Exhibit Small Working Model of Day Device" and moves the cutters crosswise of the body of the model.)

Q. 86. Well, you are still getting outside of my question. What I want to ask about and all I want to ask about just now is whether you do not consider the arrangement of the cutters of the Double and the Day—

A. Well, I can't see any comparison.

Q. 87. Just wait a minute—

A. I can't see where there is any comparison about the cutters of this, the way they are put on that reamer, and the other reamer. There is nothing at all the same about them as far as I can see. (The witness picks up "Defendant's Exhibit Small Working Model of Day Device.")

It was in 1890 or '91 when I used that Day reamer. I twisted the lugs several times. It came out twisted around and I took them off to straighten them. I didn't break anything except the springs. These were so light that it would not stop pulling it out. The reins are so light that it was bound to spring. A man pulling tools would be bound to pull that down and strain it so [438] as to pull it out. I don't believe that you could make this with those long reins

(Testimony of W. G. Henage.)

so that it would stand work.

Q. 123. Now, in order to prevent side play in the cutters of the Day reamer, would you not consider it possible to put dovetails on the sides of the body above the enlarged cutter portions, so that they would hold the reins above the enlarged cutter portions, and thus prevent that side play, and would that not prevent that side play, in your opinion?

Mr. LYON.—Objected to as incompetent and not a part of the prior art, no part of the Day device or alleged Day invention, irrelevant, immaterial, and being an attempt at a theoretical modification and re-arrangement of the prior invention, and an attempt to build up a prior art which did not in fact exist prior to the invention by Double of the device in the patent in suit and, therefore, totally inadmissible to prove any defense whatever, and, further, not cross-examination.

Mr. BLAKESLEE.—As to the prior art, in so far as it concerns dovetails in underreamers, the record will speak for itself.

A. I don't believe that you could make this here with these long reins so that it would stand the work.

Q. 134. I have asked as to one particular point.

Mr. LYON.—The same objection.

A. Suppose you made this solid up here. It wouldn't work, because this head wouldn't pull down. It could neither expand nor contract if it was solid. Here is where the weak part of it is. And if you protect that by grooving it would be solid.

(The witness in this last answer points to the reins

(Testimony of W. G. Henage.)

above the enlarged head of the body portion of the Day device.)

Q. 125. (By Mr. BLAKESLEE.) Supposing you put extensions on the body below the spring in the Day reamer which projected outwardly, so as to inclose the reins between them at both sides. Would you not consider this would be satisfactory in preventing side play of the cutters? [439]

Mr. LYON.—The same objection as last noted on the record.

A. It would stop the side play, but it would not strengthen your reamer, as here is the weak part of your reamer. (The witness points to the reins.)

The Day reamer never stuck in the casing. I don't know that I would consider the North reamer a tool that I would care to use; a man could get along as we could with the Day reamer in its day. We did not accomplish anything with the North reamer. At the time when I went there with the North reamer there was a considerable of a string in and I undertook to underream, but I could not underream with it. The reamer would stick and the dogs pulled in and out, and we worked with it some little time, and our pipe was getting pretty logy, or tight, and consequently we quit using it and put the pipe in and put a string of $5\frac{5}{8}$ and bought a new Double underreamer and finished the hole with the Double underreamer. After attempting to use this Day reamer we went back to driving our pipe rather than attempt to use the Day reamer further. We tried to underream with the North reamer, but it did not accom-

(Testimony of W. G. Henage.)

plish anything with it. We worked a couple of days with it. The main trouble with it was what we called "jack-knifing." The cutters would work in and out of the reamer. That is, it would open and shut. The shells are very hard and we did not make a success of reaming through it.

**Testimony of H. H. Maddren, Called as Witness on
Behalf of Complainants.**

Mr. Maddren testifies as follows:

My name is H. H. Maddren and live near Maricopa, California. Am connected with the Kern Trading & Oil Company. Am field superintendent. Our company is using Double underreamers at present. We have used Wilson reamers. I believe those Wilson reamers were [440] still in service of the Company when they were transferred to this field. The reason they were transferred from that field was we found that the Double reamer gave us better service than the Wilson and we made a standard of the Double reamer. The Wilson reamers were shipped to McKittrick, as the property we have there is very shallow and does not require nearly as much underreaming as it does either at Coalinga or here. At Coalinga on several occasions we abandoned the use of the Wilson reamers and got Double reamers to finish a well or two. We had a great deal of trouble with the cutters breaking off the Wilson reamers and also the mandrels which support the cutters. We broke some Double cutters, but we broke so many more of the Wilson cutters, and the cutter being contracted the way it was, it left a great deal harder

(Testimony of H. H. Maddren.)

pieces of steel in the well to fish out than it would in the Double cutter on account of being constructed differently. From my own experience, I should judge we broke several dozen sets of Wilson reamer cutters. We have not been troubled with the Double cutters breaking except in the very small reamers, such as in the $4\frac{1}{2}$ " reamer. We have had a good many of those broken, but probably not more than a dozen sets of either. I cannot state exactly, but I should judge we broke a dozen of the mandrels of the Wilson reamer. Most of the cutters that were broken are still in the holes and probably drilled up. It is very seldom that we were able to fish any of them out. But the shank of the cutter or the small end that remained in the bowl and the mandrels, they were usually thrown into the scrap heap and disposed of as scrap or junk. I don't know as they could be found now because our junk is being continually cleaned up and disposed of.

A. I always thought that the Wilson cutter was constructed on bad principles. That is, the lower part of the cutter was rather wide compared with the shank that holds it in the bowl. And also the manner in which it is held in the bowl. The top of the shank being the only part that receives the blow of the tools [441] when you are reaming, and the shoulders not being up against the bottom part of the bowl, it always appeared to me that that was very poor construction and was the cause of a good many of them breaking. Of course, I don't know anything about the class of material they made them

(Testimony of H. H. Maddren.)

of. That might have had something to do with it. But we had no way of telling what steel they used or anything of that kind. The Wilson reamers we had used and had had trouble with were probably purchased four or five years ago. I would prefer the Double underreamers having the narrow cutters.

A. I think it gives you more clearance and your underreamer will turn better in the hole and cut better. It is not as hard to dress as the wide cutter is. In fact, I think they are more satisfactory in most every respect. Besides, you have less danger of breaking a cutter off when it is built narrow. The first Wilson reamers give trouble to disassemble or assemble on account of the screws which hold the block in place.

A. Well, I couldn't say as I prefer the old type reamer to the new, if you take it clear back to the first reamers that were made by the Double people. There have been a good many improvements made over the older reamers in the new reamers aside from the cutters themselves.

Q. 34. Do you remember at what points the breakages took place in the Double cutters?

A. They usually broke near the eye of the cutter where the key goes through the cutter.

Q. 35. Did you have any other difficulty with the Wilson reamers than the breakages of the cutters and mandrels?

A. The first underreamers they made there were a good many difficulties. For instance, in unscrewing the set screws they had screwed in the sides of the

(Testimony of H. H. Maddren.)

bowl to support the mandrel and cutters and also the pins that went through the part of the bowl, we had lots of trouble in driving out the key that went through the cutter [442] and the mandrel. In fact, we had so much trouble from that source that we lost a great deal of time in drilling wells in taking off the dull cutters and replacing them with sharp cutters that were just dressed—we had so much trouble and loss of time, that very often they had to be sent to the shop and taken out.

Q. 38. Have you ever had any trouble with Double reamers due to their becoming worn down at the lower end of the body below the slot?

A. Yes; we have had underreamers that were used until they were worn out. It is just a case like any other piece of machinery. They were used till they became worn and we replaced them with new reamers.

I have never had any trouble with the joint in the body of the double reamer between the body and the sub, except lots of times when we wanted to take it apart and put in a stronger spring, or something of that kind, I would have a hell of a time breaking the joint so as to get it unscrewed. It is a large joint and pretty hard to break sometimes. That is a damn good feature. I would not call it trouble. That joint is not broken very often, and when it is set up good and tight it will stick. I did not consider it an advantage to be able to take the cutters off the Wilson reamer at the bottom without the necessity of taking off any sub. I would prefer to

(Testimony of H. H. Maddren.)

have a tool with a joint in it. It is a great deal handier in replacing that spring or the mandrel. You can break the tool in the middle and take the mandrel and spring out, and that is a good deal handier than taking it out of the bottom like you do in the Wilson. [443]

**Testimony of E. L. McCray, Called as Witness on
Behalf of Complainants, in Rebuttal.**

Mr. McCray testifies as follows:

I live in Hollywood, California. I am acquainted with Tom O'Donnell. I have known him ever since he was born. I am related to him. I am a cousin of his, his mother and my mother are sisters. I commenced to work for the Union Oil Company in 1887. I continued in the oil drilling business until 1896, when I got paralyzed. I have drilled in Bakersfield since then, but no active work around the well. I have had charge of leases. I worked in the Los Angeles field in 1900 and 1901, for six or eight months, possibly a year. During that time I saw Tom O'Donnell practically every day. I was right alongside of him. I have been on the property of the Whittier Consolidated Oil Company, in the Los Angeles fields at the wells that Tom O'Donnell was drilling there and while he was drilling. I was not any more familiar with the tools that Tom O'Donnell was using on those wells than I would be with any other tools except in the derrick. I generally noticed pretty close what tools he was using, but I never examined anything very closely about them. I had all the opportunity that a driller would have to have known

(Testimony of E. L. McCray.)

whether Tom O'Donnell had the O'Donnell and Willard reamer there to the extent practically of using the tool if I had occasion to. We never had occasion to use a reamer in the Los Angeles field, or very seldom, and I don't remember of seeing an underreamer used in that field. We had little or no occasion to use underreamers in the Los Angeles field. We did use them some, yes. I used an underreamer they called the North underreamer. I got it through Fairbanks-Morse Company of this city. The circumstances of my getting the North reamer were as follows: I had a $9\frac{5}{8}$ casing in my hole, about 600 feet of it, and I went down 600 feet below that and got a cave, and I wanted to put this casing down through that cave. I went down to Ed Double of Santa Paula, when he had [444] charge of the Union Shops, to get a reamer—to get what was called a Double reamer—and he only had a few of them made and there was none that I could get hold of, and I had to go to Los Angeles to get one, and I got one that they called the North Reamer. I could not do anything with the North reamer. We had no success with it. We could not get it to open or stay open after getting in the casing. I couldn't get the reamer to stay open. It would get clogged up and hold itself. There was nothing between the bits or lugs in the North reamer to hold the bits in expanded position, and in underreaming these bits would close in together and the mud and stuff would hold them in that position, and we would pull them out and clean them and put them back in again, and after a few revolu-

(Testimony of E. L. McCray.)

tions they would be in the same condition. I got no satisfaction out of it whatever. The North reamer I refer to was like the North Patent No. 674,793.

(Witness is shown "Defendant's Exhibit Union Oil Tool Company's circular of North Improved Underreamer" and asked if he ever saw an underreamer that looked like that). I seen several of the Union Oil Tool Company's underreamers. I have seen lots of underreamers like these, but I don't know whether they were Union's, or whose they were. I didn't follow the oil business in those days at all. There is nothing in that picture that looks like the reamer I referred to as the North reamer which I used in 1905 or '06. I don't remember of Double ever telling me anything about a North reamer.

**Testimony of W. M. Hill, Called on Behalf of
Complainants, on Rebuttal.**

Mr. Hill testifies as follows:

I am a member of the firm of Barlow & Hill of Bakersfield. I am interested in the wells on Section 29, 11, 23. My driller is Jack Bennett.

I produce a letter written by Jack Bennett to my firm, dated Oct. 26th, 1912, which refers to the loss of a 6" bit in that well. [445] This letter is as follows:

"Dear Chas:

"We are down 3850 feet and have lost a bit in hole which is liable to give some trouble as it lays over in the wall and we cannot seem to straighten it up, but may get it yet.

(Testimony of W. M. Hill.)

“Pipe is at 3842 feet and we dare not move it now on account of cave on bit.

“Will let you know as soon as we get bit out.”

We also have a letter in the handwriting of John A. Bennett, our superintendent or driller, under date of Nov. 21, 1912, addressed to our firm in which he says:

“Dear Chas:

“We pulled pipe and got bit all right; it was bent so badly it would of spoiled the whole string of pipe if we hadn’t pulled it, as it was we ruined the three bottom joints.

“We have in about 1400 feet and hope to get it all back by tomorrow evening, but we are tightening all the collars as we go along and it will take a little longer.

“I do not expect any further trouble from the lost shoe now that we have bit out of the way.”

The 6" casing used in that well was purchased from the Oil Well Supply Company, their invoice dated March 7th, 1912. This is indiscriminately referred to as 6" and 6 $\frac{1}{4}$ " casing. I have a letter from Mr. Bennett dated March 11, 1912, in which he states that “The pipe arrived to-day and we have about 700 feet at the well to-night and will finish it to-morrow.” We landed the 8" casing in the hole about 2,770 feet deep. That hole is not yet completed. The 6 $\frac{1}{4}$ " casing was landed at about 3,995 feet. I have known Mr. Bennett for about 11 years and believe him to be absolutely truthful. He is a painstaking man very

(Testimony of W. M. Hill.)

careful and a very successful driller.

The formation in the Sunset Security well to which I have just referred are very hard. Some of the formations are very hard. [446]

**Testimony of Charles S. Off, Witness Called on
Behalf of Complainant, in Rebuttal.**

Mr. Off testifies as follows:

My age is 47; am an oil operator and producer. Residence 104 N. Union Avenue, City. Have been in the oil business for (17) seventeen years. I am familiar with the use of underreamers and have had occasion to use them. I am familiar with the Plotts underreamer, the Leidecker underreamer, the Austrian underreamer, the Double and the Wilson. Also am familiar with the North reamer. Attempted to use the North reamer at Whittier.

After entering the Whittier field we found our formation there stands almost upright, almost perpendicular, making the shells also stand almost perpendicular. It was very difficult to make a perpendicular hole there. In fact, we were unable to do so without the use of an underreamer. The first one I attempted to use was the Austrian and even with great care it would break off the lugs about as fast as we would put it in. I next had them try the Plotts underreamer which held its own. We had very little breakage, but the results were very unsatisfactory because it took so long to accomplish anything with it. We had one shell in No. 3, and on No. 3 we used a Plotts underreamer for five weeks in one particular

(Testimony of Charles S. Off.)

place trying to get it rounded out for the purpose of putting the casing through, and while using that during that time I took out a North underreamer. The drillers condemned it before trying it. They said that they wouldn't use it and went on to state what the particular weak points were that caused them to object to the use of it. So I finally induced them to try it and they tried it for two days with great care and accomplished nothing with it. Then we tried the Plotts again and finally got the Double underreamer and did the work in about five hours with the old style Double. [447]

I am familiar with the O'Donnell and Willard underreamer. The El Moro Oil Company well was drilled by my brother-in-law, R. A. Moranville. The El Moro well was about three-quarters of a mile from my property. I met Tom O'Donnell of Los Angeles, California, in the Whittier field. I know of the attempted use of the O'Donnell & Willard reamer at the El Moro well. At that time my brother-in-law told me he had tried the O'Donnell & Willard reamer and that it did unsatisfactory work, or, in fact, did not do any work; that you couldn't make it do satisfactory work. I saw that underreamer. It was hauled or rolled down onto our property and we had a team take it from that point—had it taken away. We had use for an underreamer at that time. We talked with Sam Frampton and Tom Frampton, my drillers, in regard to it at that time. Mr. Frampton refused to use it. My brother-in-law, Mr. Moranville, died about four years ago.

(Testimony of Charles S. Off.)

After first going to Santa Maria field, Tom and Sam Frampton drilled a well known as well No. 1 on Wright's Ranch Oil Company. It became necessary to use an underreamer and I understood there was a Leidecker there and, not being able to get a Double reamer handily or to get a Double reamer at that time, we used the Leidecker several times. The work was not successfully done with it, and we got a Double underreamer and continued our work with it.

Prior to getting the Double reamer there was great necessity for the use of an underreamer in California. From my experience with the Austrian reamer I would state that it was not a success for the reason that the formation stood almost straight, the shells being very hard and they would break off on the lugs. The face seemed to be too wide for the shank or the shanks too weak for the lug, and it broke off. I would say that I found the cutting surface was too great for the shanks, making the shanks weak and causing the cutter to break. [448]

It was my intention to use the Wilson underreamers if possible in the Maricopa field, and I ordered the Wilson underreamer for use in California Diamond B X, 8¼ casing—28 pound casing. When the underreamer arrived it was impossible for us to get it to properly enter the casing. I sent word to the house at Bakersfield that the underreamer was unsatisfactory and that we couldn't use it—that it wouldn't enter. So they sent a young man out—a representative—who, they stated at that time, would show

(Testimony of Charles S. Off.)

us how to use the underreamer. He came out there and he was at the well for two days and part of a third day, during which time it was impossible for him to get the underreamer to enter the casing. That is, to go down into the well. It would go down sometimes fifteen or twenty feet and it would catch and wouldn't go forward, and we would bring it back. We finally got it down to about 400 feet after three days more trial. Then we took the underreamer off and informed the people at Bakersfield that we couldn't use it and that we would return it, which we did. I got a Double underreamer and finished putting down the 8 $\frac{1}{4}$. I got the underreamer for the purpose of putting the 8 $\frac{1}{4}$ down. Then when we—I will have to make a statement that I am not positive whether it was a 10-inch or 8 $\frac{1}{4}$. I used two underreamers. I got the first one and it didn't work satisfactorily, and then I ordered a second one. I came down to the Wilson & Willard factory and had a talk with Mr. Wilson or Mr. Willard, rather, explaining to him the trouble I had had with the first underreamer, and I notified their man to get the underreamer down, and in giving the order for the second one I made especial mention of the fact that they should so construct the underreamer that it would enter the casing, and in place of doing the work the underreamer came up there and we tried to use it and we had the same trouble with it. We couldn't get it to enter or go through the casing. [449]

It was Diamond B. X. casing. I had used Wilson

(Testimony of Charles S. Off.)

reamers previous to that. I had had no trouble with the Wilson reamers before in entering the casing. Possibly the reamer which gave me trouble was not constructed right in the lugs and too much metal in the lugs or cutters. As far as I know the Wilson reamer is a successful reamer.

We had no trouble in getting the Leidecker down into the casing or out of the casing. My recollection is that it did not ream the shell.

The North reamer which we used in 1902 and '01 did not do the work satisfactory. I cannot state particularly what the reason. We did get some service out of the Plotts reamer. I have used both the old style and the Double improved reamers. I prefer the old style. It has a little less cutting surface, giving the upper part of the cutters relatively more strength. I do not think the increase of cutting surface in the latter type of Double improved an advantage in itself. It weakens the shank and I find in the formations that we have to encounter that the former pattern—or rather that with the cutting surface is more satisfactory and not so apt to mud up as the latter pattern of Double reamer. The calf wheels and the wire rope in handling is of very considerable importance and an advantage. It saves time. It would be practically impossible to put down as deep wells as we do to-day with the old style of light casing. Heavy casing is absolutely necessary in present day heavy drilling. All the other factors, namely, the calf wheel, the wire line, play an im-

(Testimony of Charles S. Off.)

portant part in deep well development. (After cross-examination witness is asked to step into the next room where he will find the exhibits in this case and see if he can find therein anything like the O'Donnell & Willard reamer which he says was tried in the El Moro lease. Witness puts his foot on the body of the "Defendant's Exhibit O'Donnell & Willard Underreamer.") That looks like the one. [450] Referring to the reasons for the continuance of the use of the Plotts underreamer by the Murphy Oil Company, I believe the reason for their having used the Plotts' underreamer the length of time they did, was because Mr. William Plotts, its supposed inventor, was manager and superintendent of the Murphy Oil Company for a number of years and, therefore, endorsed his own instrument by using it. I remember the drillers of the Murphy Oil Company making complaint of the Plotts' underreamer.

**Testimony of Chester W. Brown, Witness Called on
Behalf of Complainants, in Rebuttal.**

Mr. Brown testifies as follows:

My name is Chester W. Brown, residence 204 Union Avenue, Los Angeles, age, 44, occupation, manager of the field department of the Union Oil Company. I have been in the oil business since 1887. I started as tool dresser. I worked in connection with the drilling of wells in Ventura County, California, until 1894, then went to Los Angeles and operated in the Los Angeles fields, and from there went to Peru, South America. Am familiar with under-

(Testimony of Chester W. Brown.)

reamers and their use. The first underreamer we attempted to use was the Day underreamer. We used or attempted to use that reamer on well #3 on the Astarta Oil Company in the Ojai District, in Ventura County in 1890. Beside myself working on that well was Homer Hennage, E. G. Chamberlain, John McGee, I was tool dresser at that time.

We endeavored to use this reamer to carry our string of 55 $\frac{5}{8}$ casing, as I remember the size; but we were continually breaking it, losing parts of it in the hole, and finally—I am just trying to remember whether we used that to a finish on the well or whether we drove that the latter part. I think we did. Finally resorted to driving our pipe instead of trying to underream. [451]

I produce the original book of logs of the wells drilled at that time; these wells now being the property of the Union Oil Company, and the book being a part of its records. Subsequently to drilling this Astarta well I drilled other wells in Ventura County, but did not use this Day reamer. We drove our pipe. In 1891 we used the same reamer in the Bardsdale field, in Ventura County on well #1. It was a failure. The rock being harder, we broke the mandrel and lost the stem in the well expanded. On the log of that well I notice the following:

“At 1060 feet an attempt was made to run an underreamer, but the keys broke and left half of it in the well expanded.” That refers to the Day reamer. We drove our pipe after that. I consider the Day reamer too frail to be of any consequence.

(Testimony of Chester W. Brown.)

On Cross-examination.

(By Mr. BLAKESLEE.)

Q. 33. Where are the keys of the Day underreamer which you have referred to as broken in 1891 in operation?

A. I have not referred to them as keys. This is the old record made up by the engineer then. I presume that he perhaps refers to this that I would call the mandrel as the key, which works through here.

Q. 34. My recollection of your record is that it refers to "keys" in the plural. What two or more parts could your record refer to in this Day reamer?

A. Well, I couldn't say, because the record is made up not by myself, at this time. It is kept by an engineer, Fenn, and I only remember this in a hazy sort of a way, that we lost the underreamer in there expanded and had no way to fish it out.

Q. 35. Is your recollection of the construction of Day reamer itself equally hazy and do you rely upon the model which had been submitted to you for examination to make certain the [452] construction of this reamer?

A. No, sir. Quite to the contrary, I remember it very well. It was one of the first run in the fields at that time.

Q. 36. Where did you procure this Day reamer?

A. I don't know. It was sent to the field by the manager for us to run.

Q. 37. Of your own recollection, then, you cannot point out on this Day model the parts referred to in

(Testimony of Chester W. Brown.)

your record as "keys" which your record states were broken? Is that correct?

A. No; I could not. But, I would say that it was the mandrel.

I was present at the time the Day reamer was lowered into the 1891 hole when it was broken. Just the upper part of the mandrel comes out. That is the part which I think may have been referred to as the key. Right here I would say I am not sure as to the construction of the square part and the round, whether that was a solid body or whether it was, perhaps, fastened with keys at that point. The round part which is covered by the spring may have been connected by keys to the square mandrel which worked through the head. Our record shows that we were in red sandstone. That is a formation which I do not think is encountered outside of Ventura County. It is softer than the usual formation. We broke the Day reamer the first time that we used it. We never accomplished anything, we never lowered any casing through any hole that we reamed with it. The Union Oil Company, the company I am associated with, is affiliated with the Union Tool Company. In using the Day reamer in 1890 we used that reamer I would say for several weeks, during which time springs were lost and drilled up, reins were broken; the reamer was sent to the shop to be repaired, and we always drove the pipe that followed our operation of underreaming. With the weight of stems and tools we use now-a-days, I don't think the Day reamer

(Testimony of Chester W. Brown.)

would stand half a dozen blows. We thought it reamed in places and then in other places where the rock was harder we thought it did not. As we drilled, however, the reamer advanced downwardly below the depth where we commenced [453] reaming. At the time of running the Day reamer if there was anyone that had had any experience running underreamers at that time it was Hennage. The record on which a log of the well on which the Day reamer was used was kept different from the way we keep them to-day. It was written out, after the wells were made by the drillers, and perhaps there were some things they forgot to put in. There is nothing on the record that shows where we began, nor where we left off, with the reamer. I would think that we reamed altogether over a hundred feet with it.

Our company is interested in the Lakeview properties in the Kern River field in which Mr. Charles Off is connected. It was my understanding that there was some common ownership of the stock of the companies of the Union Oil Companies and the Union Tool Company. We did not buy any more Day reamers and I never saw one after that. After losing this Day reamer in the Bardsdale well I think we drilled about ten other wells in that locality.

**Testimony of B. N. Youngken, Called as a Witness
on Behalf of Complainants in Rebuttal.**

Mr. Youngken testifies as follows:

My name is B. N. Youngken; age, 42; resident of Los Angeles; field superintendent for the Union Tool

(Testimony of B. N. Youngken.)

Company. Have been connected with the manufacture and sale of oil well tools and machinery since 1889. I was in the employ of a company in Santa Paula who conducted a hardware store, namely, the Santa Paula Hardware Company, and they also ran a machine-shop.

The machine-shop department was afterwards known as the Union Tool Company. I have been with that company for practically twenty years. Four years of that time I have been with other companies. Was with this company during 1889, 1890 and 1891. I repaired underreamers and am familiar with them. We repaired the [454] Day reamer. A portion of the upper part of the rein was bent and twisted. This lower portion, or the cutter, was missing. I put the reamer together after the new part was made.

I am familiar with the North Improved Reamer. I think Mr. Jones, the machinist in Santa Paula, showed me the model of that reamer. I next saw it being manufactured by the Union Tool Company's Shop of Los Angeles. W. O. Maxwell was in charge of the Recruit Oil Company.

I was very favorably impressed with this reamer as manufactured by the Union Tool Company at that time, and asked them to send me some reamers to the Orcutt shop, that I might push this reamer. They sent me three reamers to the Santa Maria field. One of these was used by the *Recruit* Oil Company, one by the Union Oil Company; the third reamer has never left the shop.

(Testimony of B. N. Youngken.)

Mr. Maxwell was the first to try out this reamer, to the best of my knowledge, in the Santa Maria field. They were both used very close together; the time of operation was very close. Mr. Maxwell took this to his property and the first that I heard of it going to the bad was when he came into the shop with the T-bar bent and had me straighten it. I straightened it and he took it back to the lease. And afterwards I think he called me up on the 'phone and told me that the reamer had fouled in the hole, and they could not get it out—when they got it out one cutter was broken and the bar bent again. I immediately had a new reamer sent from Los Angeles, of the Double pattern, to replace this reamer. Mr. Teatsorth's experience with this reamer was very similar, with the exception that I think he only ran it once and had to strip the casing or cut the line—had trouble or difficulty in getting it out—and never used it the second time. That, I am not sure of, but it is the best of my knowledge from what I can remember at the time.

Why, I would not try to dispose of the third reamer that I had there, under any circumstances at that time, being afraid to [455] let it go out. Later on, I had opportunities to rent other reamers, and not having any reamer—nothing but this reamer at the shop, I would laughingly offer to let them take this reamer and use it if they wished to but told them of the experience that I had had with the other two reamers and would advise against them using it; and I have also offered to give the reamer to a person if he wanted it. So far nobody ever accepted the op-

(Testimony of B. N. Youngken.)

portunity. The reamer is still at the Orcutt shop, with the exception of the sub or upper portion of it, which has been used for some other purpose. The body and cutters are intact as they came from the Los Angeles shop.

During my service I have repaired Wilson Underreamers, drilling out the bolt at the bottom and the retaining bolt the two short bolts which hold the block. Also have straightened the lower portions of the body where they have spread.

Well, the reamer is constructed at the bottom as a slot clear through the body, and thus has a tendency, in these cases of which I speak as repairing the reamers, to have spread outwardly sufficiently to cause the people using the reamer to be afraid to use them in that condition any longer and it was necessary to heat those and close them together.

I do not know of any Austrian underreamer in use in the fields. I have a recollection of, a few months ago, somebody asking me if I knew where he could get hold of one, and I told him I did not know where he could secure one. From the year 1902 on until about the middle of 1904 I worked in the shop. What I heard about underreamers was generally from men who came to the shop. I worked on Double reamers and other reamers that were brought to the shop for repairs. We made keys, etc., for reamers, I don't think I can give any particulars in detail as to what repairs were given Double reamers in 1902, 3 or 4, although that is twelve years later than the work I did on the Day reamer which I remember very well. During the years 1902, 3 and 4, I was not with the

(Testimony of B. N. Youngken.)

[456] Union Tool Company. At that time I was with the Webster Iron Works. I was also in a Shop at Santa Paula the name of which I think was the California Well Tool Works. I also worked a few months for the Bakersfield Iron Works.

The most breakage to Double underreamers is the cutters. The dovetails of the Double reamer bodies break also. I don't remember any keys of the Double reamer being broken in the last year. I don't say that there has not been keys broken during that time. Such breakages or reports of breakages are generally reported to me from the Los Angeles office. And it is my duty to inspect it.

I returned in 1904 to the Union Tool Company. About the last of August or September. The first that the new style Double Underreamer, namely, the Type as shown by "Complainant's Exhibit Double Underreamer," came to my knowledge while I was in Orcutt. I should judge that was in 1905. The first Wilson reamer I saw was brought by the Associated Oil Company or the Recrude Oil Company to Orcutt. That was in the latter part of 1905, I think.

During the last two years in which I have been visiting the Oil Fields regularly, I do not remember of having seen a broken Tee or spring-actuated mandrel of Wilson underreamer. Do not remember of ever having seen any broken Wilson underreamer cutters. On the other hand, I have seen broken Double cutters practically every trip I make through the fields. I saw a broken Double underreamer body on my last trip through the fields, the same reamer or

(Testimony of B. N. Youngken.)

reamers I have seen at previous times. I don't recollect of seeing any new breakage in the underreamer or cutters within the last two or three months. I possibly have, but I don't recollect just the exact incident right now. There are a number of broken Double underreamer bodies which I have seen in the fields during my last three months. The dovetails would be broken out of them. I remember seeing one Wilson underreamer body with the side broken off of it. I don't know whether you would call that the dovetail broken off or not. It was right through here. (Witness refers to [457] Complainant's Exhibit Wilson Underreamer No. 2 and draws his pencil across the projecting portion just above the bottom bolt and on a line with the square shoulders at the top of the side thrust-bearings for the cutters.) I have paid no attention to the breakage of the Wilson reamer and consequently could not answer those questions intelligently as to breakage of the Wilson reamers. I have seen several of them that were spread at the bottom. I would not say when or where. I remember one reamer that was brought into the shop. I never considered it anything new to have the Wilson reamer bend in that particular locality. I do not remember of seeing any other broken Wilson underreamer body. It was during 1906 or 07 that I saw a Wilson reamer body that was spread apart. It was heated and the prongs were closed together to the proper position. The Day underreamer and the Double underreamer both have cutters which expand over a central body. That

(Testimony of B. N. Youngken.)

body is fixed to a string of tools. I consider the Double underreamer like "Complainant's Exhibit Double Underreamer" has a stronger body than the Wilson. There would be a side strain on the Day underreamer cutters. Eliminating the upper-end of the cutter-rein, the upward thrust is taken on the body at the bearing of the V-shaped groove. The side on the cutters would cause a twisting or a corkscrew action of the reins. Based upon my experience as a machinist and in observing the use of underreamers, I do not think you could make the reins of this Day reamer sufficiently strong to withstand the reaming action without having the reins so stiff that it would be impractical inside of the dimensions, required. They would be so stiff that I should think it would freeze in the casing, like a casing spear. My opinion that the Double underreamer body is stronger than the body of the Wilson underreamer is based on the construction of the two bodies, not upon the breakages that have occurred to either one of them. I don't know which has the stronger dovetails not having measured them. I don't think the extended bearings at the lower end of the Double underreamer as shown by "Complainant's Exhibit [458] Double Underreamers," namely, the Double improved, in any wise braces the cutters against which tends to rock or twist. We sell more Double improved types than any other type.

(Copies of letters patent number 862,317 dated August 6, 1907, again offered in evidence, and same to be marked "Complainant Exhibit Double Patent No. 862,317.")

**Testimony of Thomas J. Griffin, Recalled on Behalf
of Complainants in Rebuttal.**

I have heard W. W. Wilson's testimony and also that of E. C. Wilson and I do not agree with them that the inclination of the dovetails on the Double underreamers is necessary to effect the expansion of the cutters or bits of the Double reamer. The dovetails of the Double reamer are inwardly and upwardly inclined, has nothing to do whatever with the contraction or expansion of the Double cutters. They are simply for the purpose of retaining the cutters in position, either sidewise or outward. They perform no function in the expansion or contraction. When the Double reamer is in reaming position and is being pinched in a hard shell or other formation and the upward movement of the tools takes place, as soon as the cutters begin to slide downward, the points of the cutters are allowed, by these upwardly and inwardly inclined dovetails, to contract at their lower points, thereby relieving the binding tendency on the points of the cutters, and the further down they come the greater contraction is allowed, until they come to the V-shaped grooves on their inner surfaces, and there it tilts over the spreading-bearing, allowing the cutters to completely collapse.

The initial relief at the ends of the cutters of the Double underreamer, and that of the Wilson underreamer cutters is identically the same. The principle of operation is identically the same. [459]

A. 277. In the Double underreamer body there is, on each side two dovetails that are upwardly and in-

(Testimony of Thomas J. Griffin.)

wardly inclined, allowing the cutters, as they pass down, to collapse or to begin to collapse on their downward travel, thereby allowing them to relieve themselves of any pinch or bind that may be occasioned by the dull bits. In the Wilson reamer body there are two sets, mechanically speaking, the same as in the Double, with the exception that they are parallel to the body. On the lower portion of the slotted extension of the Wilson reamer there is a taper-bearing, or taper-bearings, that engage with the inner surfaces of the cutters. The cutters, near the top ends of the shanks on their dovetails, are cut away to an angle comparing, mechanically speaking, to the bevels on the spreading-bearings of the slotted extension of the Wilson reamer, allowing a tilting action, and, as the bits or cutters are bound or pinched at the lower cutting surfaces as the tools are withdrawn from the hole and the cutters binding, as the cutters start down their plane or bevel surfaces and slide downward, the binding tendency is, similarly as in the Double, relieved. If, as is shown in "Complainants' Exhibit Wilson Reamer No. 2 T-bar," this upper portion of the dovetails on their outer surface were not cut away, they would not tilt over their spreading-bearing, nor would they have the same tendency to collapse at their lower portions, as the T-bar and thickness of the cutters up to and including their dovetails have simply a clearance movement, and if this portion of their dovetails was not cut away the cutter would slide out parallel to its original reaming position. Owing to the fact that

(Testimony of Thomas J. Griffin.)

the upper portion of the shank of the cutter is parallel with the axis of the reamer body, the dovetails being parallel to the axis of the body, the T-rod being parallel, there would [460] only be the slight rocking or shaking of the reamer lugs and they could not contract—as I will illustrate by placing the lugs upon the mandrel and forming a pressure sufficiently to carry the weight of the cutters at their upper ends, they would be bound, and not allowing them to come into their position, as there is about one and a quarter inches of surface above the fulcrum on the T, thereby binding it, and it would not contract.

The difference is simply a matter of changing the angles.

A. 279. The angles that I have referred to are on the lower portion commencing at the end of the wedge-shape bearing and continuing upwardly and outwardly to the square shoulder on the body. On the Double reamer this is inverted and is placed on the upward and inwardly inclined dovetails.

Q. 280. You state that in the Wilson underreamer, for example, "Complainants' Exhibit Wilson Underreamer No. 2," the thrust-bearings at the lower end of the slotted extension are inclined slightly upwardly and outwardly and that the dovetails of the body are straight, and have referred to the fact that in the Double underreamer these thrust-bearings are straight and the dovetails upwardly and inwardly inclined. In what manner is there any correspondence between these two constructions, Mr. Griffin?

Mr. BLAKESLEE.—Objected to as leading, and

(Testimony of Thomas J. Griffin.)

particularly in view of the assumption as to the function of the upwardly and outwardly inclined parts referred to as of the structure of the Wilson Underreamer.

A. Mechanically speaking, their functions are identical.

Q. 281. (By Mr. LYON.) What difference, if any, does it make in the principle of action or mode of operation or interrelation of the bits or cutters with the body of the reamer in collapsion [461] or expansion in inclining or tapering the dovetails and using a straight thrust-bearing parallel with the longitudinal axis of the body of the reamer, or inclining such thrust-bearings as in "Complainants' Exhibit Wilson Underreamer No. 2" and using a dovetailing which is straight and parallel with the longitudinal axis of the body of the reamer?

Mr. BLAKESLEE.—Same objections.

A. None.

Q. 282. (By Mr. LYON.) With relation to each other, are such surfaces, to wit, inclined dovetails and straight thrust-bearings or the straight dovetails and inclined thrust-bearings, in any different relation, so far as the expansion and contraction of the bits is concerned? If so, state what that difference is.

Mr. BLAKESLEE.—Objected to as leading; and it is submitted that the inquiry as to what relation exists would be a more proper inquiry, with respect to such objection.

Q. 283. (By Mr. LYON.) In view of the objection, and to obviate the same, I will ask Mr. Griffin to

(Testimony of Thomas J. Griffin.)

state what these relations are of the surfaces that I have referred to.

A. I don't know as I just get that whole thing, it is so muddled up. The objection and the second question there has got me just a little bit off of the line. I will ask that the question be re-read.

Mr. LYON.—Read the last question. (Last question read by the Special Examiner.)

A. (Continuing.) Why, the relations of the surfaces to the “Complainants’ Exhibit Wilson Underreamer No. 2” and the Double reamer surfaces referred to, are identically the same—with, there may be a small difference in degrees of angle—and they perform identically the same function.

Q. 284. What difference, if any, is there in the manner in [462] which these surfaces in the two exhibits referred to by you perform said functions?

Mr. BLAKESLEE.—Objected to as leading.

A. The Double dovetails are upwardly and inwardly inclined and the Wilson is upwardly and outwardly inclined—a mere matter of degree.

Q. 285. (By Mr. LYON.) You have not answered as to its function, yet.

A. And their functions are identically the same one with the other.

Q. 286. And as to their manner of performance of those functions?

A. As to the manner of performing their functions, they are the same.

Q. 287. You have stated that the inclination of the dovetails in the Double underreamer performs no

(Testimony of Thomas J. Griffin.)

part in the expansion of the bits. Can you produce any device from which you can demonstrate this?

A. I can.

I produce a 5" Double reamer body with upwardly and inwardly inclined dovetails removed. This reamer with cutters was made at the Union Tool Company Works at Torrance. The bits which I have produced fit this body and the body is one of the regular manufacture of Double underreamers. The dovetails were removed under my instructions to demonstrate that the inner and upwardly inclined dovetails have nothing to do with the expansion or contraction of the cutters, and are simply for the purpose of guides.

The upwardly and inwardly inclined dovetails on the Double Underreamer body are for the purpose of guiding the cutters and preventing them from falling out or dropping out when the tool is in operation, and for the purpose of giving strength to corresponding [463] dovetails on the shanks of the cutters. This strength is to prevent the cutters, their upper ends or shanks, from coming out; also for the purpose of preventing the lower parts, or assisting in preventing the lower parts, next to the lower end of the shank, from swinging outward when the tool is in operation by them coming in contact with the inner faces of the upwardly and inwardly inclined dovetails and also the outward face of the dovetail on the cutter, thereby giving the reamer body, or the cutters, an additional amount of strength. "The coacting dovetails on the bits and body of the Double reamer brace

(Testimony of Thomas J. Griffin.)

or strengthen the reamer against outward strains, preventing them from spreading out."

(The body and cutters produced by witness are offered in evidence as "Complainant's Exhibit Double Underreamer with Dovetails Removed.")

No changes of any kind have been made in the body or cutters of this exhibit, except to plane off the dovetails of the body. After having these dovetails planed off this exhibit I verified my testimony that without such inclined dovetails the expansion of the reamer would be the same. It is identically the same.

Q. 302. (By Mr. LYON.) What did you find, Mr. Griffin, after planing off the dovetails of the last exhibit produced by you, was the effect of the upwardly inclined dovetails, so far as the expansion of the bits was concerned? And I refer particularly to the principle of operation and coaction of the parts in expansion.

Mr. BLAKESLEE.—Objected to as indefinite, inasmuch as the exhibit shows that the dovetails have been mutilated or removed, eliminating any deduction as to what their action was.

Mr. LYON.—Just read the witness the question. (The last question was read by the Special Examiner.) [464]

A. Planing off the upwardly inclined dovetails, I found, by comparison, the upward or inward incline of the dovetails had nothing to do with the expansion or contraction of the bits, and their function was simply a guide or retaining mechanism or feature, as the inner surfaces of the bits at the upper ends

(Testimony of Thomas J. Griffin.)

of the lugs and the lower surfaces are parallel to the parallel slotted extension of the Double underreamer, thereby showing conclusively that the dove-tails have nothing to do with the expansion or contraction of the lugs or cutters, and the only function, as I have stated before, is for the purpose of guiding the cutters in their upwardly and downwardly movements and giving strength thereto, preventing the cutters from being driven out at their lower points.

Q. 303. What difference, if any, is there in the mode of operation or principle of coaction existing between the body of the underreamer and the bits in the old style and new style, so called for convenience, of the Double underreamer as exemplified in "Complainants' Exhibit Double Underreamer" and "Defendant's Exhibit Double Underreamer"?

A. None whatever.

They play no part in contraction or expansion of the cutters.

The V-shaped grooves on the Double improved are placed there for the purpose of preventing—as a preventor, if needed, in underreaming. If the tools come in contact with such as a boulder, pieces of iron, or that the driller, as often is the case, reams his hole down below, or attempts to ream it below, his drilled hole, and gets on solid rock, or that he runs his tools in a crooked hole, and one of the lugs would be working free and the other lug would be digging into the wall of the crooked hole—in that event these V-shaped notches come into play; and also, if there should happen to be a boulder or hard

(Testimony of Thomas J. Griffin.)

[465] point of rock projecting from any cause at the side of the drilled hole and one of the lugs striking it and driving it outwardly from the center of the body and bending the cutter, or having a tendency to bend the cutter—that this V-shaped notch would be an assistance in the protection of the cutter. It does not come in contact, however, with the body of the cutter unless some accident happens thereto. And if the driller was running his tools slack and not holding them up, so as each stroke of the reamer would get the reaching or spring of the line effect, and working his tools, which is often the case, too heavy, having a stem, jars, and sinker-bar attached thereto, which is quite often an occurrence in this hard drilling—in that event he would have the tendency, or the reamer lugs would have a tendency, probably to spring out, and this V-shaped dovetail would be of assistance in preventing such spring, as, as soon as they begin to spring, the shoulder of the cutter would come in contact with the inner surface of the V-shaped notch.

Q. 306. (By Mr. LYON.) Mr. E. C. Wilson testifies that, “When the underreamer is in operation, probably the greatest force applied against the cutters, unless it be the actual end-thrust of the cutters against their bearings at the upper ends of their shanks, is the tendency to crush the lower ends of the cutters towards each other.” In the actual use of underreamers what have you found in this regard, Mr. Griffin?

A. Owing to the conditions in which you are

(Testimony of Thomas J. Griffin.)

underreaming. When the cutters are sharp and in good condition, the cutter has a tendency to dig out into the walls, and it would be right the reverse, as the angle upon which the bits are dressed have a wedge-shaped action on the surface drilled, as a chisel setting at that angle would dig into the wall, thereby having a tendency of spreading the cutters; but as the cutter becomes dull and run [466] too long, and *dubs* the cutting edge of it, the lugs then have a binding tendency and a tendency to wedge in toward the body of the reamer, throwing a great strain, or considerable of the strain, on the face of the central portion of the Double underreamer and against the lower portion of the slotted extension of the Wilson.

Q. 307. In your experience in underreaming, would you say that the greatest force applied against the cutters was thus outward, or inward?

Mr. BLAKESLEE.—If this question is based upon the quotation from the testimony of the witness E. C. Wilson, attention is called to the fact that the greatest stress of all on the cutters is admitted to be an upthrust.

Mr. LYON.—The statement of counsel is objected to as not evidence. If he desires to testify in the case he can be given an opportunity to do so.

Mr. BLAKESLEE.—And we object to the question as indefinite and misleading.

A. The greatest force is outward.

Q. 308. (By Mr. LYON.) And that has a tendency to do what with the bits?

(Testimony of Thomas J. Griffin.)

A. To spread the lower portion of the bit.

Q. 309. To spread the bits away from each other, you mean?

Mr. BLAKESLEE.—Both of the preceding questions are objected to as leading.

A. Yes, sir. [467]

**Testimony of Thomas J. Griffin, for Complainants,
Recalled in Rebuttal.**

Direct Examination Resumed.

(By Mr. LYON.)

Q. 310. Mr. E. C. Wilson has testified, in reference to the result of machining the V-shaped shoulders and grooves in "Complainants' Exhibit Double Underreamer," that it included, amongst its other effects, the extension of the spreading-bearings and thrust-bearings, and states: "This extension transfers the fulcrum or the point of contact further down on the cutters when the cutters slide or tilt over this spreading-bearing." Do you agree with Mr. Wilson? A. I do not.

Q. 311. Why not?

A. If I understand Mr. Wilson's answer, and the question, correctly, referring to this answer, the machining of the V-shaped notches on the lower end of the mandrel has not changed the fulcrum of the cutter, as the fulcrum of the cutter in the old style Double is substantially the same as in the new style with the V-shaped notches.

Q. 312. Referring, Mr. Griffin, to that part of Mr. Wilson's question and answer included in the pre-

(Testimony of Thomas J. Griffin.)

ceding question, in which he says "The point of contact" is transferred further down on the cutters by reason of this V-shaped notching, what have you to say? A. It has not.

Q. 314. In what manner has the cutting or utilization of the V-shaped notches in "Complainants' Exhibit Double Underreamer" in any manner affected the length of cutters or bits which can be used in the Double reamer?

A. The length of the bits, in either the old or the new type of Double reamer, can be lengthened or shortened and will still do their same work. [468]

Q. 317. Mr. Wilson, in his testimony, has referred to a tendency to "rotate the cutters in the dovetails," throwing the heavy outward strain at one side of the shank and an inward strain of the cutter on the opposite side of the shank," and states that, "it would probably have been altogether impractical to have widened the body of the old style Double underreamer cutter without some means of extending the bearings at the backs of the cutters correspondingly. This could not have been done with the old style Double underreamer cutter, as by that form of construction there was no point on the old style Double underreamer body on which said bearings on the cutters could have rested." What have you to say in regard to this?

A. I differ with Mr. Wilson as to the practice: First, by widening the cutters and not increasing the size of the shank has weakened the cutter shank. As to its rotative inclination, the dovetails of the

(Testimony of Thomas J. Griffin.)

cutter and corresponding dovetails on the body of the mandrel are for the purpose of preventing the rotation, and, when such action would take place, the force of that action would be against the dovetails on the body, ripping them out, which occurs in the narrow cutters correspondingly with the broader or wide cutter, and for that reason the V-shaped notch was placed at the bottom of the body, so as to take away the additional strain that might come if this accident or point of operation should occur; and, if such was the case, without the V-shaped notches it would have a tendency to rip the dovetails from the body.

Q. 318. Then, does the extension of the thrust-bearings laterally in any manner tend to counteract such tendency to rotate, where no supporting or bracing shoulder like the V is used? [469]

A. No.

Q. 319. In "Complainants' Exhibit Wilson Underreamer" or Wilson underreamer No. 2, what is there to counteract the tendency of the cutters to rotate?

A. The dovetails.

Q. 320. And where is such strain of such tendency taken up?

A. On the dovetails of the cutters and the corresponding dovetails of the body.

Q. 321. And where is such corresponding strain taken up in the old style Double underreamer, "Defendant's Exhibit Double Underreamer," and in the device as shown in the drawings of the patent in suit, "Complainants' Exhibit Double Patent"?

(Testimony of Thomas J. Griffin.)

A. On the dovetails of the cutters and corresponding dovetails of the body.

Q. 322. Then, if I understand your testimony, the extension of the flat surface below the V-shaped notches in "Complainants' Exhibit Double Underreamer" and the corresponding extension of the single flat surface on the inside faces of the bits to bear there against, has no effect in taking up this strain?

Mr. BLAKESLEE.—Objected to as leading.

A. It has no effect in taking up this strain, whatever, or assisting in taking up this strain. The V-shaped notch is put there for that purpose; as, when the bit or the reamer would attempt to rotate by striking on some hard substance on one corner or receiving a blow on one corner and attempt to twist, in place of throwing all the strain on the dovetails this V-shaped notch would assist in taking that up. I wish to add to that, that, in "Complainants' Exhibit Double Underreamer with Dovetails Removed" by shoving the cutter in the slotted extension up against the thrust-bearing, it having the dovetails removed [470] therefrom, you cannot twist this lug out of position, as it comes in contact with the V-shaped notches.

Q. 323. (By Mr. LYON.) I show you a body, and ask you if you have ever seen it before.

A. I have.

Q. 324. Please explain what this body is.

A. This is the lower portion of the body of a so-called Improved or so-called New Style Double 4½

(Testimony of Thomas J. Griffin.)

inch Underreamer with the slotted extension, or the outward portion of the slotted extension, including the dovetails, removed on one side; on the other side showing the dovetails in that part of the reamer intact, with the slot of the extension extending through the circle of periphery of the reamer body. It also shows the thrust-bearing that is used for the shank of the cutter, and receives the blow from said shank of the cutter. It also shows the spreading-bearing clear across the body of the reamer, and shows the slotted extension which is used for the key or a T-bar, as the case may be, and it can be increased in size to any desired width for the purpose of receiving a key of any desired thickness, or T-bar; and further shows the spreading-bearing over which the cutters expand and contract in their regular operation.

Mr. BLAKESLEE.—It is asked that all those portions of this answer which do not purport to be descriptive of this body under discussion itself, such as the statement, “It can be increased in size to any desired width,” be stricken out and withheld from consideration, as not responsive to the question, and as merely speculative.

Q. 325. (By Mr. LYON.) What was the object, Mr. Griffin, of machining away one side of the hollow slotted extension of this body?

A. To clearly demonstrate these points; and to further [471] show what function the dovetails of the body and corresponding dovetails of the cut-

(Testimony of Thomas J. Griffin.)

ters perform. Also, to show the width of the spreading-bearing.

Q. 326. What knowledge have you of the machining away of the one side of the hollow slotted extension of this body? A. I ordered it done.

Mr. LYON.—Complainant offers in evidence the body which has just been referred to by the witness, and asks that the same be marked “Complainants’ Exhibit Double Underreamer With One Side of the Hollow Slotted Extension Machined Off.”

(The exhibit last referred to and offered in evidence is marked “Complainants’ Exhibit Double Underreamer With One Side of the Hollow Slotted Extension Machined Off.”)

In order to illustrate my statement that the slot in which the key or head of the spring actuated rod moves vertically may be of any desired width I introduce herewith an old style Double $4\frac{1}{2}$ ” reamer body. This number is 163, Reamer made in 1903.

Q. 335. And what changes, if any, have been made in this body in its condition as originally manufactured?

A. It has been placed upon the milling machine and the slotted extension, beginning at the lower portion or spreading-bearing, has been milled out up to the thrust-bearings, and a hole drilled in the lower portion crosswise of the slotted extension and a retaining-bolt with the nut on the opposite side placed therein.

Q. 336. And what does this illustrate?

A. It illustrates that the slotted extension can be

(Testimony of Thomas J. Griffin.)

increased in size to receive a T-bar or a key of any desired style or form or size; and also illustrates and demonstrates that the cutters will expand and contract over the spreading-bearing just the same as if the lower part of the central portion that [472] is now occupied by the pin hadn't been removed.

Q. 337. And what effect, if any, would it have upon the manner of co-operation of the bits and body portion, or their principle of action, in expansion or contraction, if the thrust-bearings for the cutters just above the spreading-bearings were widened still further toward the periphery, or clear to the periphery, or the tool?

Mr. BLAKESLEE.—Objected to as leading, and and as assuming that an underreamer organized in accordance with the hypothesis of this question would be capable of displaying by operation any mode of operation or interrelation of parts whatsoever, the testimony having not shown that any trial was ever made or attempted of any underreamer organized as presupposed in the question; and as purely speculative.

A. It would absolutely have no effect on the expansion or contraction of the reamer.

Q. 338. (By Mr. LYON.) What change, if any, from the original mode of operation of principle of co-operation of the bits upon the body in expansion and contraction, has the machining out of the metal from this body had?

Mr. BLAKESLEE.—Same objections; and the further objection is made that the witness has at

(Testimony of Thomas J. Griffin.)

no time qualified to answer any such purely hypothetical question.

A. None whatever.

Q. 339. (By Mr. LYON.) And how does the present mode of operation, as embodied in this exhibit, and using therein the same construction and form and size of bits originally utilized therewith, compare with such mode of operation and co-operation of the bits and body in expansion and contraction as originally made?

Mr. BLAKESLEE.—Same objections as noted in the last two instances. [473]

A. They are identically the same.

Q. 340. (By Mr. LYON.) Do you know the circumstances under which this machining out of this body was performed? A. I do.

Q. 341. State. A. Myself.

Q. 342. For what purpose?

A. For the purpose of demonstrating that Mr. W. W. Wilson's answers—I can't recall the exact question or answer, or the number of page of the question and answer—were erroneous, when he testified that if the central portion of the Double reamer was removed there would be no expansion or contraction, and that the bits or cutters would swing idly and would not operate.

Q. 343. And what are the facts in such regard, Mr. Griffin?

A. Why, unquestionably they will operate, and pretty successfully.

Mr. BLAKESLEE.—Objected to as not respon-

(Testimony of Thomas J. Griffin.)

sive. The question called for the fact. The answer did not purport to give the facts, but merely opinion.

Q. 344. (By Mr. LYON.) These facts have been demonstrated by you in what manner?

A. By placing the cutters therein and expanding them and contracting them; and their expansion and contraction are identically the same since this milling was done, or the removing of the central portion of the slotted extension, as it was before.

Q. 345. What other changes, if any, have been made in this body, other than simply milling out a quantity of the central metal and the insertion of this bolt at the bottom?

A. None. There has been no other work done on the body.

Q. 346. Then, otherwise than as described by you heretofore, the body remains in the same shape as originally made as a part [474] of Underreamer No. 163 by the Union Tool Works in 1903, is it?

A. Yes, sir.

Mr. LYON.—The body produced by the witness is offered in evidence and marked “Complainants’ Exhibit Double Underreamer With Enlarged Slot.”

Mr. BLAKESLEE.—It is believed that this designation of this exhibit is not as full and not as accurate as if it were as follows: “Complainants’ Exhibit Double Underreamer With Hollow Slotted Extension Partially Removed and Bolt Added at Bottom.”

Q. 347. (By Mr. LYON.) Mr. Griffin, has the

(Testimony of Thomas J. Griffin.)

hollow slotted extension in this exhibit been removed? A. No, sir; it has been enlarged.

Q. 348. You mean the slot has been enlarged?

A. Yes, sir.

The body produced by the witness is offered in evidence and marked "Complainant's Exhibit Double Underreamer With Enlarged Slot." The hollow slotted extension of this reamer has not been removed. The slot has been enlarged.

Q. 349. Will you compare this last exhibit with the similar portion of "Complainants' Exhibit Wilson Underreamer No. 2" and point out the similarities or difference, if any, which are material.

Mr. BLAKESLEE.—Further reference to this exhibit during the course of rebuttal proofs in this case, with any assumption that it shows anything operative, is objected to on the ground that no proofs have been adduced to prove any such operativeness, no testimony having been adduced as to the use of this exhibit in any actual practice or in any manner amounting to a working test thereof; and the use of this exhibit as evidence—that is, the exhibit last introduced—is objected to as to anything further than a mere hypothetical structure or an arbitrary modification, [475] the utility of which has in no manner been proved.

A. They are substantially the same. The "Complainants' Exhibit Wilson Underreamer" has a key about one and a half inches above the shank thrust-bearing, which the Double exhibit has not. One other slight difference is that the portion above the

(Testimony of Thomas J. Griffin.)

spreading-bearing of the Double has not been machined off similarly to that of the "Defendant's Exhibit Wilson Underreamer No. 2." Otherwise they are substantially the same.

Q. 350. (By Mr. LYON.) What difference in the mode of operation or principle of coaction or co-operation of the bits and body portion of the underreamer in expansion and contraction does the cutting off of the portion last referred to by you make?

A. None. They are substantially the same.

Q. 351. What have you to say as to the operative-ness of this last exhibit as an underreamer?

A. That underreamer will operate and do good service.

Mr. BLAKESLEE.—It is asked that this answer be stricken out as merely reflecting an opinion; not the best evidence; no foundation laid for secondary evidence.

Q. 352. (By Mr. LYON.) Referring to the testimony of William W. Wilson, in answer to Q. 15 he says: "In the Double underreamer the expansion of the cutters is caused by contact of suitable faces on the cutters with the main body of a wall or projection of the extension shown at 6. In order to allow the cutters to collapse over this extension, pockets are cut in the backs of the cutters, these notches being on the shank or upper extension of the cutter. No such means are necessary in the Wilson reamer." Do you agree with Mr. Wilson in this testimony? If not, state any reasons for disagreeing.

(Testimony of Thomas J. Griffin.)

A. Now, the question, Mr. Examiner, and the quotation.

The SPECIAL EXAMINER.—“Referring to the testimony of [476] William W. Wilson, in answer to Q. 15 he says: ‘In the Double under-reamer the expansion of the cutters is caused by contact of suitable faces on the cutters with the main body of a wall or projection of the extension shown at 6. In order to allow the cutters to collapse over this extension, pockets are cut in the backs of the cutters, these notches being on the shank or upper extension of the cutter. No such means are necessary in the Wilson reamer.’” A. Yes, sir.

The SPECIAL EXAMINER.—“Do you agree with Mr. Wilson in this testimony? If not, state any reason for disagreeing.”

A. I agree with Mr. Wilson. That is the case, as shown.

Q. 353. Do you agree with Mr. Wilson that “no such means are necessary in the Wilson under-reamer?” A. I do not.

Q. 354. What similar or substantially the same means are necessary or utilized in the Wilson reamer?

Mr. BLAKESLEE.—Objected to as leading.

A. I wish to here correct myself in the previous answer, as I was misled in the question or I misunderstood the question and the quotation.

Q. 355. (By Mr. LYON.) Make your correction. (To the Special Examiner.) Just read the question, with the quotation, and his answer, and any-

(Testimony of Thomas J. Griffin.)

thing else on the record he wants, and then let him make his correction.

The SPECIAL EXAMINER.—“Referring to the testimony of William W. Wilson in answer to Q. 15 he says: ‘In the Double underreamer the expansion of the cutters is caused by contact of suitable faces on the cutters with the main body of a wall or projection of the extension shown at 6. In order to allow the [477] cutters to collapse over this extension, pockets are cut in the backs of the cutters, these notches being on the shank or upper extension of the cutter. No such means are necessary in the Wilson reamer.’ A. Yes, sir. The Special Examiner: ‘Do you agree with Mr. Wilson in this testimony? If not, state any reasons for disagreeing.’ A. I agree with Mr. Wilson. That is the case, as shown.”

A. I wish to say that the expansion and contraction of the cutters of the Double and Wilson reamer are substantially the same, and I disagree with Mr. W. W. Wilson, as the inner faces of the Double cutters are utilized for the expansion and contraction over the spreading-bearing on the lower end of the Double reamer, and also the inner faces of the Wilson cutters are utilized and spread over the spreading-bearing on the lower portion of the hollow slotted extension of the Double and the hollow slotted extension of the Wilson substantially the same.

Mr. LYON.—Now, read him the last question which he has not answered.

(Testimony of Thomas J. Griffin.)

The SPECIAL EXAMINER.—“Q. 354. What similar or substantially the same means are necessary or utilized in the Wilson reamer?”

Mr. BLAKESLEE.—That is the question to which I objected.

The SPECIAL EXAMINER.—Yes.

A. They are substantially the same, and the same means.

Q. 356. (By Mr. LYON.) Will you point them out to us?

A. This is the lower portion of the hollow slotted extension of the Double reamer over which the cutters expand and contract, and this is the lower portion of the slotted extension of “Complainants’ Exhibit Wilson Underreamer No. 2” over which the cutters expand and contract. [478]

Mr. BLAKESLEE.—Pointing to the lower ends of the prongs or body of the exhibit.

Q. 357. (By Mr. LYON.) Now, show us what are the inner surfaces of the bits of “Complainants’ Exhibit Wilson Underreamer No. 2” which coact with the part just referred to by you.

A. This is the part of the cutter that I have referred to that coacts with the lower portion of the slotted extension of “Complainants’ Exhibit Wilson Underreamer No. 2.”

Q. 358. (By Mr. BLAKESLEE.) Now, point to them, will you?

A. I have got my fingers on them.

Mr. LYON.—Witness puts his fingers upon the two shoulders at the sides of the shanks of the bits,

(Testimony of Thomas J. Griffin.)

and on the inner surfaces just below such shoulders.

Q. 359. In expanded position what is between the cutters or bits, respectively, in the Double underreamer and the Wilson underreamer?

A. The lower portion of the slotted extension of the bodies.

Q. 360. Is that a fixed piece and one part of the body integral therewith, or a movable part?

A. That is a fixed part of the body.

Q. 361. In both the Double and the Wilson?

A. In both the Double and the Wilson.

Q. 362. And for what purpose is such part in both the Double and the Wilson?

A. To hold the cutters in expanded position and to allow the cutters to contract over the same solid portion of the body.

Q. 363. If the dovetails on the shanks of the Wilson bits or the dovetails at the sides of the slot in the body of the Wilson underreamer were removed, what would there be to guide the upper ends of the cutters into position?

Mr. BLAKESLEE.—Objected to as merely a hypothetical question, [479] calling for a conclusion upon the part of the witness, and for his mere naked opinion, and as leading, and particularly in assuming the presence of any slot, as such, in the Wilson reamer body; and irrelevant, immaterial and incompetent for any purposes of rebuttal proof.

A. The upper ends of the cutters would simply fall out and would be inoperative; that is to say, the cutters would expand and contract but they would not stand any service.

(Testimony of Thomas J. Griffin.)

Q. 364. (By Mr. LYON.) Mr. W. W. Wilson, in his testimony, in his answer to Question 15, says: "In the Double underreamer the cutters are expanded to working position, first, by spreading—means introduced between the backs of the cutters, and, second, by the upper ends of the cutters traveling upward on the inclined dovetailed ways, drawing the upper ends of the cutters closer together;" and, also, "In both the Wilson exhibits the cutters are expanded solely by having expanding-means thrust in between the outer edges of the cutter." Do you agree with Mr. Wilson in this testimony; and, if not, state wherein you differ.

A. I do not agree with Mr. Wilson in his statement, as the dovetails of the Double reamer have nothing to do whatever with the contraction or expansion of the Double cutters. They are there merely for the purpose of preventing the cutter from coming out or falling off the key and for the purpose of preventing the sidewise movement or the outward movement from the central portion of the body, and do not pertain to the expansion or contraction of the cutter and have no relation to it.

Q. 365. And how do the dovetails and their inter-relation to the spreading-bearing and thrust-bearings and the cutters in the Wilson underreamer, both as exemplified in "Complainants' Exhibit Wilson Underreamer" and "Complainants' Exhibit Wilson [480] Underreamer No. 2," compare with this expansion and contraction of the Double?

A. They are substantially the same.

(Testimony of Thomas J. Griffin.)

I do not agree with Mr. Wilson in regard to the sub or joint. I do not consider that the extra joint increases any of the hazards. The joint in the sub is very much larger and much stronger than any joint in a string of tools.

Q. 372. What have you found, in your experience, to be the comparison between the Double and the Wilson underreamers in regard to the facility for adjusting the tension on the spring-actuated mandrel or rod and the removal and replacement of the bits or cutters?

A. It is very much easier to remove and replace the cutters of the Double reamer than the Wilson, as, ordinarily, it will not take more than five minutes, at the outside, to put on a set of new cutters, or sharp cutters, on the Double reamer, and the adjustment of the spring-actuated mandrel or rod, when once set up properly, does not have to be touched or changed. Owing to the fact that you screw an eye-bolt in the bottom of the mandrel and fasten that to the derrick floor or place thereon a suitable amount of weight and tramp up your tools until this action brings a strain, or expands the spring sufficiently to take the tension off of the key that goes through the cutters and spring-actuated mandrel, pulling out one of the small cotter-pins that go through the outer portion of the bit directly across the lower portion of the slot in the shank of the bit, push the key out at this juncture, remove your cutters by pulling them down out of the dovetails, shoving up into the dovetails the new set of

(Testimony of Thomas J. Griffin.)

cutters, pushing in the key through one of the cutters, thence through the mandrel and into the other cutter, and placing the cotter-pin, or driving it in, and then your cutters or reamer [481] is ready to be run back into the hole. With the Wilson Complainants' Exhibit 4½" Reamer it was quite a proposition to put on a new set of cutters, often having to take this body to the shop and placing it under the drill-press and drilling out the dowel-pins that hold the retaining-block that is located just at the upper ends of the hollow slotted extension, and also to drill out or saw in two the retaining-bolt, or drill it out, at the lower end of the slotted extension. After that was removed, the dowel-pins and retaining-bolt, then you could pull the spring-actuated T-rod down and remove the old cutters, replace the new, and shove back into the slotted extension, screw in new dowel-pins if the others had to have been drilled out, otherwise the old, and shoving up into position, holding one side up with a pin while you screwed one of the dowel-pins on the opposite side into position, thence the opposite one where the pin was in, and then putting in your retaining bolt or safety-bolt at the lower ends, thence putting in your cotter-pins or Keys to prevent the dowel-pins and the retaining-bolt from unscrewing, necessitating a great deal of time and trouble. In "Complainants' Exhibit Wilson Underreamer No. 2" they have replaced the old T-rod by a differently constructed T, being much larger, with an elongated slot therein, and have also added a slot through the hollow

(Testimony of Thomas J. Griffin.)

portion near the thrust-bearings of the shanks about one and a half inches above the same, and placed therein a key that has shoulders on each side or just sufficiently wide to allow the said shoulders of the key to drop inside of the bore of the mandrel, thereby preventing the key from being lost, owing to the fact of it being driven in and under and through the slot in the body and the spring-actuated T-rod, or, if necessary, to take out, by the use of a small chisel or other instrument, driven under one corner on [482] the lower side of the key, raising the key up by placing a strain or contracting movement on the spring, and thence be driven out by a small punch or a key. That releases the spring-actuated T-rod. All, then, that is necessary to do is to unscrew, if possible, the retaining-bolt at the lower ends of the spreading-bearings—making it a simpler and quicker operative device than their old. But still, with this improvement, I do not think that you can remove the cutters and replace the cutters on this exhibit as quickly as you can on the Double.

Q. 373. Mr. W. W. Wilson, in his testimony, says that the bottom bolt is a feature of the Wilson reamer which does not exist in the Double reamer. Do you agree with him in this? A. Yes, sir.

Q. 374. He says that this bolt comes into use only when excessive wear or breakage of other means provided for limiting the cutters takes place. Do you agree with him in this statement?

A. I do not.

Q. 375. Please explain.

(Testimony of Thomas J. Griffin.)

A. This retaining-bolt at the bottom of the Wilson reamer is an absolutely essential feature, as it is at all times under a tension, serving the purpose, first, in the event of the T-rod breaking, that—at the upper end, I speak now of “Complainants’ Exhibit Wilson Underreamer No. 2.” If that rod was to break at or near the upper portion of the elongated slot, that this retaining-bolt would then prevent the cutters from falling into the well, if the reamer at that period was being pulled out of the casing. But, if it was broke, and continued to attempt to operate the reamer, it would burr up the upper portion and would probably bend and the cutters would be lost in the hole. That is one of the features of the retaining-bolt. If the retaining-bolt was not there, a boulder or any hard substance coming in [483] contact with the lower portion of the slotted extension would have a tendency to spread and throw an immense strain outwardly, and if it were not for the retaining-bolt it probably would drive itself up between the cutters, stripping the dovetails from the body and losing the cutters and T-bar with the string of tools in the hole. Also, it acts as a safety when the reamer comes in contact with the drilling of a crooked hole or striking on a partially reamed circle at or near one corner of the cutter, which is often the case, throwing a tremendous strain sidewise, giving the tools a rotary motion. If this pin was not in there the slotted extension portions would spread. In “Complainants’ Exhibit Wilson Reamer No. 2” I find that this

(Testimony of Thomas J. Griffin.)

reamer is sprung, I having personally taken this reamer off of a string of tools that was being operated at the time I went to the well, and I find by placing the calipers thereon, though it had the retaining-bolt therein, that it is sprung.

In regard to Mr. Kibele testimony that he ordered his Wilson reamers made without safety bolts, I will say I recently visited Mr. Kibele in Bakersfield and on examining his reamers at the Bakersfield Iron Works noticed that all of them—three—had the retaining bolt in position.

Q. 381. (By Mr. LYON.) You have now referred to so much of the tilting action as is embodied in the initial contraction of the Double. Have you completely stated your exceptions to Mr. Wilson's testimony in regard to there being no tilting action in the Wilson reamer similar to the tilting action of the cutters on the key or T of the spring-actuated rod of the Double?

A. I have not.

Q. 382. Please compare such action, and state wherein you disagree with Mr. Wilson.

A. I disagree with Mr. Wilson, from the mere fact that the [484] tilting action of the cutters on the T-rod of the Wilson and the spring-actuated rod and key of the Double are substantially the same.

Q. 383. What difference is there in that?

A. None.

My opinion is the Canadian underreamer was a makeshift.

A. 385. The Canadian underreamer—so-called

(Testimony of Thomas J. Griffin.)

underreamer—is not even, in my estimation, a make-shift. First, that it is too weak. In days gone by, when they underreamed, or attempted to underream or use this tool with pole-tools—to be plainer, instead of the rope cable or wire lines, such as now are used, it was intended to be used with a string of poles—in the day and time when they used the shin skin casing and practically no shoe—a very light, thin and short, flimsy shoe, and in soft clayey formation—this underreamer might have been used to scrape off the sides of the walls and allow this shin skin casing and shoe to follow, as the casing in those days could not even be dropped, or “spudded,” as now called, as the weight would telescope itself, and the tool as constructed now would not stand on a string of tools for the second lick: First, because the cutters passing through the body are retained by a small bolt coming against shearing-shoulders on the shanks of the cutters, and if this bolt did not shear off, causing the loss of the lugs in the hole, they are so flimsy and thin and long that the first lick that would be struck on any solid formation they would be bent and doubled up or broken off in the shanks and lost in the hole. This tool I don’t consider a safe tool to run into anything with a cable and line. And, further, it has not the expansion, nor can it be made, in the present form, to have sufficient expansion, to ream a hole large [485] enough to allow the shoe and casing such as used and has been used in this field, or the oil fields, for many years, and would be considered by me as a dangerous piece of

(Testimony of Thomas J. Griffin.)

junk to run into a hole.

I have seen cut in catalogue Oil Well Supply Company, figure 2161, many times during the last 13 years, in the Oil Well Supply Company's catalogues, and have often wondered how such a reamer would be or could be operative, and have many times with other people tried to figure out how the cutters were fastened together at their lower portion, or directly across the spreading-portion of the mandrel, and surmised what kind of a contrivance could be placed in there to withstand the outward strain that I know is on a cutter, and I have wondered what kind of a dovetail it might be interposed between the cutters at their spreading-surfaces to prevent them from twisting around the mandrel or main portion of the body. In looking at Figure 2161 Underreamer Canadian pole tool system, and carefully scrutinizing the cutters, apparently this cut must have been made from a drawing, as the cut shown shows a very much thicker portion or shank. It also shows that the white line interposed between the mandrel and the body comes very near up to the top. It even shows that this white line comes to the center portion of what I now know as the retaining-pin, thereby misleading and not showing any portion of the upper ends of the shanks going in and interlocking as they now do. I have often been in the storerooms of the Oil Well Supply Co. at various places. I never saw or heard of one of these Canadian reamers in any of such stores. I never saw one, but I asked their general manager, one day, Mr. Carmody, who was

(Testimony of Thomas J. Griffin.)

located at the time at Corsicana, Texas, in 1900 or 1901, if he knew anything about this Austrian or Australian or Canadian underreamer; that I [486] would like to see one, as I was going to drill a well for Shanghai Pierce, down in the southwestern portion of Texas, and thought that I would have to have a reamer, and I wanted to select something that was good. He says, "Griffin, I have been with the Oil Well Supply Company for many years, having been sent out here from the Pittsburg house, and I never saw one of those reamers, and I don't think that we have any or could even get one for you. I think it is a drawing or cut that they carry in the catalogue for the purpose of filling up."

Mr. BLAKESLEE.—It is asked that all that portion of the last answer which purports to be something that Mr. Carmody stated to the witness be stricken out and withheld from consideration, as not a statement made in the presence of any of the parties to this suit, not the best evidence, and no foundation laid for secondary evidence, and that manifestly the best evidence would be gained by producing the party, Carmody, or somebody capable of testifying to the same matters.

I do not agree with Mr. W. W. Wilson that there is no slot or slotted extension in the bottom of the Wilson underreamer.

This is a slot in the Wilson underreamer extending from this point clear out to the lower portion, namely, that opening between the prongs or the reamer.

(Testimony of Thomas J. Griffin.)

With the Double Reamer Complainants' Exhibit or Defendants' Exhibit the cutters when collapsed bear against the lower portion of the spreading-bearing.

When the cutters of the Wilson underreamer are collapsed they bear identically the same as the Double, their lower spreading-bearings, the shoulders of the cutters on their inner faces bear against the lower end of the body or spreading-bearings.

Direct Examination in Rebuttal Resumed. [487]

Q. 403. Will you please compare the action in collapsing of the Double and Wilson underreamer bits in the Double underreamer and Wilson underreamer of the exhibits last referred to? And I refer particularly, in this question, to such collapsion as exists when the underreamer is drawn back into the well-casing at the bottom of the well.

A. In both the Double and Wilson exhibits, also the alleged old style type of Double and the old type of the Wilson underreamers, their action when coming up out of the hole at the bottom of the casing-shoe is that the casing-shoe strikes on the Double at the outward shoulder, which is located just above the small holes of the sides of the cutter and is used for the purpose of retaining a cotter-pin. Comparing this described shoulder with the Wilson, I find that the shoulders correspondingly are in the same relative position. When this action takes place, the cutters or bits stop. The tools or body-portion of the reamer continue to move upward until the inner faces of the lower portion of the lugs pass the outer-

(Testimony of Thomas J. Griffin.)

most corner of the wedge-shaped spreading-bearing, and at this point they collapse almost instantly over the wedge-shaped lower spreading-bearing, allowing the cutters at this point to start on their upward movement with the body of the reamer, being in contact at this time with the outer surface of the bit with the inner sides of the casing. And I speak of the normal contraction of the cutters only, in this comparison. And the two different types of reamers, both Double and Wilson, contract in identically the same manner.

Q. 404. You have identified the particular shoulder referred to by you in the Double underreamer bits, and I will now ask you to point out the shoulder which you refer to on the Wilson bit, [487½] the one that the casing contacts with.

A. This is the shoulder that I have reference to that comes in contact with the inner rounded surface of the casing-shoe. This shoulder that I speak of is located on the outer surface of the cutter, about one and three-quarters or two inches below the thrust-bearing of the shank.

Q. 405. And how, in point of location with respect to the pivot-point upon which the cutters tilt on the spring-actuated rod, do these shoulders, respectively, in the Wilson and Double bits compare?

A. They are as near the same as they could possibly be put. The reason for bringing the contact of the casing-shoe close to the pivot or tilting-point of the cutters is to permit the cutters to tilt on the spring-actuated rod. If the contact is below that

(Testimony of Thomas J. Griffin.)

point the action would be sliding, or if it was above this point it would be binding.

Q. 410. You have referred to this answer of yours in regard to the normal contraction of the cutters only. In case the underreamer was in expanded condition below the well-casing and pinching should take place, what action is brought into play, if any?

A. At that point it has an entirely different action. When the reamer is expanded and is in working position and is bound in a hard formation, the cutting edge of the cutter having been dubbed off, as the cutter starts down the slotted extension, owing to the mandrel portion being pulled upward on the upstroke of the tools, the outward edges of the cutters binding holds the cutters in position, or stopped, until the mandrel rises sufficiently to clear the thrust-bearing of the cutters. As soon as this takes place, the outward binding tendency against the wall of the hole [488] is relieved, owing to the fact of the upward and inwardly inclined dovetails allowing the cutter to tilt slightly over the lower portion of the spreading-bearing, thus causing a very slight sliding movement of the cutter shank on the key. This description describes the action of the Double cutters. In regard to the Wilson, when the reamer is in position, reaming, and becomes pinched or bound in this same formation as the Double, the outer or cutting surfaces of the reamer lugs being pinched, remain in stationary position until the upstroke of the tools raises the mandrel or body sufficiently to allow the cutter to slide downwardly over the slightly

(Testimony of Thomas J. Griffin.)

tapered bearings sufficiently to allow this binding tendency to become released; then the spring-actuated rod, acting in the same manner with the Double as the Wilson, pulls the cutters back up into position against their thrust-bearings; and the tendency to relieve the cutters, one with the other, is identical, from the mere fact that the slightly tapered cut-away portions of the Wilson body allow the gradual contraction and expansion, which is substantially the same for all purposes and answers for the same purposes as the upward and inwardly inclined dovetails of the Double.

Q. 411. The action which you have referred to in your last answer is what you have heretofore referred to as the initial collapsion of the bits in the Double and Wilson reamers? A. Yes, sir.

Q. 412. And, if I understand your testimony correctly, this feature is for the purpose of taking up any possibility of thus having the bits pinched in the well? Is that correct? A. Yes, sir.

Prior to my experience as a driller of oil wells I served my apprenticeship and time as a machinist with the Ames Iron Works, in Oswego, New York; with them four years. Was then foreman of the [489] Lee's Iron Works, Galveston, Texas, for nearly two years. Then with the Santa Fe Railroad shops at Galveston. The head machinist of the Galveston Cotton & Woolen Mills.

After hearing the testimony of Albert Shinneller I found upon inspection that the Murphy Oil Company of Whittier are using nothing but Double un-

(Testimony of Thomas J. Griffin.)

derreamers. This was a few days after Mr. Shinneller testified. I also found Double reamers on the property of the Central Oil Company of Whittier. Also Double reamers are being used in the Salt Lake fields exclusively. I did not find any Wilson reamer in use there.

A. 433. I knew this as a fact when I was there with the Niles Lease Company; and just before the beginning of the taking of testimony in this case I was requested by Mr. Lyon to secure a Wilson underreamer to exhibit, and I told him I could get one close to town, and a small one, as the Salt Lake Oil Company had a full string—I thought four or five—reamers laying on their tool-rack, and that I could go out and get one for him, as they were not using them, to my personal knowledge, having discarded them and thrown them into the scrap-list.

In regard to the North Underreamer, patent #674,793.

Q. 439. What have you to say in regard to such a construction of an underreamer or tool?

A. First, I would say that such a constructed tool is inoperative and would be a dangerous tool to run in a hole.

Q. 440. Give your reasons.

A. First, because there is no partition between the cutters to prevent them from collapsing and expanding with the least particle of friction on the lugs. Such partition is necessary to take the inner thrust of the cutters.

Nothing to keep them from "jack-knifing," in

(Testimony of Thomas J. Griffin.)

other words. There is nothing in the North underreamer construction to resist that jack-knifing. [490]

A. 442. They work on a hinge similar, I mean, to a knife-blade and the handle. As, for instance, taking a knife by the end of the blade and the end of the handle, it closes very easily, owing to the fact that it has a rounded bearing, throwing a very small amount of the spring-tension on the back, allowing the knife to open and shut very easily. I further find, as shown in Fig. 1 of the North underreamer patent, a feature which is clearly inoperative. For instance, as clearly shown here, the T-rod, f, comes down below the lower portion of the bowl, allowing the cutters and T-rod to turn around, circularly, thus throwing this T-rod out of the slot that is made in the bottom of the bowl to receive said T. Therefore the cutters could not expand or contract. From the drawing, I should say that this T-rod comes down from one-half an inch to an inch and a half below said bottom of the bowl, which is the thrust-bearing which imparts to the cutters, 6, its thrust-bearing. I also find that this tool would be inoperative owing to the locking-mechanism being very weak, flimsy, and not designed so that it could possibly be operative. I do not find any comparison whatever in the mechanical construction of this tool and the Double, with the exception of two features, one of which is the pin located on the upper portion of the sub, and the other is the spring, G, normally holding the T-rod in position.

(Testimony of Thomas J. Griffin.)

A tool constructed along the lines of the Day under-reamer is clearly an inoperative device. I do not consider such a tool safe to be run inside of a casing, even just to run it in and pull it out without doing any reaming. First, owing to the fact that the cutters, when in contracted position, are parallel, and when such a tool as this would be run in the hole and the outer surfaces of the cutters would be working and in contact with the inner walls of the casing throughout their entire length, the [491] point or cutting edge also would be in contact, and if you would run this tool in the hole and it came to a joint in the casing where the pipe was not made up shoulder to shoulder, these cutting edges would instantly go into the casing and injure your casing. If you did get such tool in the hole and attempted to ream on any hard shell with the standard stem and jars as we use in a well for drilling purposes, the first lick that would be struck, probably, would push the reins of the cutters and throw them out of line, there being no dovetails or retaining-means on either the dart-shaped portion or the thrust-bearings thereof of the lower portion of the cutter, nor no dovetail or retaining-means at their upper thrust-bearings, which is constructed in a V-shaped notch against a removable portion of the tool by means of keys or dowel-pins engaging the rounded portion of the stem with this enlarged part of the body, making that part of the reamer very weak. And, again, if the tool was operated for a short time in the hole, it would naturally become filled with mud or drill-

(Testimony of Thomas J. Griffin.)

ing, which is at all times of a sticky formation; it would wedge up between this block portion and the cross-head in and around the spring, thereby not allowing it to collapse, and it would also fill the rounded portions of the lugs which causes the cutter to expand and contract over this V-shaped portion, thus binding this tool, and when it come in contact with the casing-shoe and the dart attempted to get into this rounded portion located on the inner faces of the cutters, it would proceed to pull the dart up higher, thus expanding the cutters, and at that time you could not possibly get this reamer back in the bottom of the casing. In the course of drilling the tendency, as I have previously explained, and which has been demonstrated—for instance, ripping the dovetails from the bodies of the Double reamer and the Wilson reamer, this same [492] action would force these lugs outward and would bend their reins up and twist them possibly beyond description. Therefore I should say that such a tool as is disclosed in the Day patent would not even be a makeshift, and I would not consider such a tool as one that could be taken on a lease and attempted to be used, with any degree of safety.

To make the reins of the Day reamer heavy enough would make them too stiff to spring and they would not collapse. It would bind the cutters in against the dart to such an extent that I don't think you could pull the reamer out of the casing.

The underreamer disclosed in the O'Donnell & Willard Patent #762,345, is neither mechanical nor practical.

(Testimony of Thomas J. Griffin.)

A. 456. As to its practicability, based upon my experience with underreamers, first, I find that there is no thrust-bearings on the shanks of the O'Donnell & Willard underreamer. Further, that such a device as disclosed is inoperative, from the mere fact that the collapsing pressure that is brought to bear upon the cutters is away down below the fulcrum of the cutters, making the cutters expand and contract in such a way that they are not practical, there being no slotted extension for the shanks of the cutters to tilt in and out, causing a binding pressure upon the cutters transferred into the division or central screwed-in portion, creating a great deal of friction. Neither is there any dovetails or guides guiding the cutters. And, again, that it throws the thrust-bearing upon the circular circumference of the body and upon the shoulders of the cutters, giving an action there that is binding, not allowing the cutters to swing in freely and ride over their outer faces, necessitating some device by which they could be locked down while going into the casing and below. No such locking device on an underreamer, to my personal knowledge, has ever been tried and [493] found either safe or satisfactory in an underreamer, from the reason that when an underreamer is lowered below the casing-shoe it is necessary in all instances to find the bottom of said shoe. With a tripping mechanism or projection that sticks out through the side of the body, the driller would not be able to tell whether it was the retaining mechanism in the

(Testimony of Thomas J. Griffin.)

body or locking device that come in contact with his shoe or whether it was his lugs. Therefore he would not know where or how to hitch over his tools, and if he hitched them up too high, having been deceived in finding the bottom of his shoe with his cutters, after a few strokes of the beam his locking device would be broken off or so badly disfigured it would render the tool and device absolutely impracticable. And, again, in the O'Donnell & Willard underreamer, I find the lugs, for all practical purposes, to be so large that they fill the circle of the hole, rendering them impractical, for the reason that any small parts of rock or drillings that could possibly work up above the lugs of the reamer would get in behind those lugs, wedge them against the wall, and not allow the reamer to be moved upward and downward. Next, that in drilling in any sticky substance, such as shale, hard clay, the tools would ball up after a very few strokes, forming a piston in the hole, and would wedge the reamer in such a shape that it would not work either up or down, as, at the sides of the lugs, in the Double reamer and the Wison reamer, there is no water course, or room for the drillings to work up by the tool. Often, when pulling out, and in the majority of instances a reamer or bit is pulled out from the hole, it is necessary to take a pick or axe and cut the hard, dry formation from the tools, and if this tool was in that kind of formation it wouldn't work five minutes. As disclosed in the patent drawings, the locking device would clearly be inoperative,

(Testimony of Thomas J. Griffin.)

not [494] only non-mechanical, but such a structure as disclosed in the drawings, I do not believe it would operate even if it was above the ground; and when that reason is so, Mr. Willard saw fit to improve on his original reamer by placing a collar and an interrelated key with lugs projecting through the sides of the collar, for the purpose of pulling the spring downward and allowing the cutters to hang inside of the casing without any tension or friction on the sides of the cutters conveyed to the walls of the casing. Such a feature as he has constructed on exhibit unquestionably is a failure, such that I would not attempt under any circumstances to run into a hole.

Mr. BLAKESLEE.—It is asked that that portion of the witness' answer relating to what Mr. Willard did be stricken out and withheld from consideration, as not responsive to the question, and particularly in view of the allegation by the witness as to the reasons moving Mr. Willard to the addition of such improved features to the exhibit "O'Donnell & Willard Underreamer"; and the continuing objection is made that the witness is testifying apparently speculatively, and merely by a statement or upon opinion, and it is submitted that such evidence of testimony is not the best evidence, the record being replete with evidence as to the facts concerning this O'Donnell & Willard underreamer, and the actual use and operation of the exhibit, "O'Donnell & Willard Underreamer."

Q. 457. (Mr. LYON.) You have referred to the watercourses in the Double & Wilson underream-

(Testimony of Thomas J. Griffin.)

ers. To what do you refer in this connection, Mr. Griffin?

A. I refer especially that it is necessary in the operation of any tools in a well to have ample room between the body of the tool and the hole drilled, for the drillings to pass freely up by the body, or between the body and the walls of the hole; and only described that as a watercourse, for the reason that [495] we use the word "watercourses" in connection with our drilling-bits.

Q. 460. You have testified that in "Defendant's Exhibit O'Donnell & Willard Underreamer," as well as in the proposed construction illustrated in the drawings and described in the specifications of "Defendant's Exhibit O'Donnell & Willard U. S. Patent Number 762,435," there are no thrust-bearings on the shanks of the cutters. On what portion of the shanks of the cutters do you mean.

A. The upper portion.

Q. 461. Or upper ends?

A. Upper ends; yes, sir.

Q. 462. Where, in these exhibits last referred to, are the vertical thrust-bearings?

A. They are on the body, the lower portions of the body, of the reamer mandrel, or at the beginning of the bowl.

Q. 463. And what portion of the bits contact with the body there against?

A. The shoulder, which is located just above the ends or cutting-edges.

(Testimony of Thomas J. Griffin.)

Q. 464. And this shoulder is disposed at all times outside the body portion or bowl of the underreamer?

A. Yes sir. That is what I had reference to when I said that any drillings that was not mixed up would get probably a little bit worked up above, and get in behind the shoulders and bind the lugs or bits.

Q. 465. From a mechanical standpoint, with such a construction as exemplified in either "Defendant's Exhibit O'Donnell & Willard Underreamer," or in "Defendant's Exhibit O'Donnell & Willard U. S. Patent Number 762,435," how would it be possible to bring the point of contact on the casing at or to the necessary relation [496] with the pivot or fulcrum point of the bits on the spring-actuated rod to secure the proper collapse and expansion of the bits? A. It would be utterly impossible.

Q. 466. What feature of construction is it in the Double and Wilson underreamers which permits such relation to be gained?

A. The slotted extension.

Q. 467. And the projection of the backs of the shanks of the cutters through the slot of such extension? A. Yes, sir.

Q. 470. For what reason?

A. For the reason that the cutters are encased inside of a bowl; the backs of the cutters not coming in contact with the casing at or near their fulcrum points; there being no fixed partition between the cutters, and this being a locking device, necessitating the holding down of the cutters until past below the casing, which has previously been dropped into the

(Testimony of Thomas J. Griffin.)

well; a block of wood to drive the wedge up between the cutters, spreading them out into an expanded position, forming a positive lock; and such a tool would necessarily piston itself—could not relieve itself at any time, when being pinched in that shell, but would bind and hang, springing the tools, until, when they did come loose, they would have a tremendous spring or jerk, bounding upwardly in the hole, and the probabilities are catching the tools on their upward stroke, giving a tremendous strain on the line or cable, and probably parting the cable and losing the tools in the hole. This reamer compares to the O'Donnell & Willard, having its thrust-bearing in the same relative position; no slotted extensions for the bits passing through the sides of the body to ride in and out of the casing at or near their fulcrum.

Q. 471. You said that there is no partition or portion fixed to the body, and immovable with respect to the body, lying between [497] the bits, when in expanded position, in this Kellerman reamer. In this respect, to what other exhibit introduced on behalf of the defendant does this correspond?

A. To the North. And I wish to correct a portion of this last answer, by saying when I referred to the O'Donnell & Willard I intended to say to the North.

Q. 472. You have referred to the action of the North cutters or bits, and their liability to "jack-knife." With respect to such action, what have you to say with regard to this Kellerman exhibit?

A. Its action would be practically the same, for

(Testimony of Thomas J. Griffin.)

the reason that if the locking device—which I seriously doubt—were ever a success, the spreading-wedge would be below the cutters, and would give them identically the same “jack-knifing” effect as the North.

Q. 473. What have you to say as to the comparative principle of coaction or cooperation of bits and body portion, in expanding and contraction, in this Kellerman Exhibit, as compared with such action in the Double and Wilson underreamers?

A. There is no comparison between them. It has no relative principles of either reamer embodied.

Q. 474. In other words, then the Kellerman is totally different in this respect? A. Yes, sir.

A. 477. Is this “Defendant’s Exhibit, Sample of Swan Reamer,” substantially the Leidecker or Swan reamer to which you referred in your former deposition on behalf of complainants? A. Yes, sir.

Q. 478. In what manner, if at all, does the principle of action or co-operation of the bits and body of this exhibit compare with the principles of action or co-operation of the bit [498] and body portion of the Double or Willard underreamers, in expansion and construction?

A. There is absolutely no comparison in the action, either contracting or expanding, of the Swan patent or the Swan exhibit, with the Double or Wilson.

Q. 479. Is there any tilting action of the bits in the Swan reamer? A. No, sir; there is not.

Q. 480. Upon what is the Swan reamer dependent, in collapsed position of the bits?

(Testimony of Thomas J. Griffin.)

A. It is dependent upon the spring-actuated interlocking rod.

Q. 481. And how does this locking of the spring-actuated rod take place?

A. By an enlarged portion or enlargement of the spring-actuated rod shown in Figure 7, and the dowels, which have suitable slots, as shown in F2.

Q. 482. Is that a large or small F?

A. It is a large F, and small 2—in Figure 10. These pieces are made flat and long, with little projecting pins that fit into suitably drilled holes, that pass through from the outer surface of the body to the central portion, so that when the lugs, with their spring-actuated rod, are pulled down, these lugs are held in position by a suitable ring, as shown in Figure 9G, until the reamer is placed in the top of the casing; then these lugs shown in 10F come in contact with the walls of the casing, and are finally held in position, preventing the cutters from being pulled up until after these lugs F go below the shoe, when they are forced out, allowing the enlarging portion of spring-actuated mandrel rod to pass up between these points, and in the event that they don't hold, have a drive-down casing [499] spear, which in eight cases out of ten, based on my experience in running this tool into the hole, is the case. Sometimes I have gotten the tool almost to the bottom of the hole when this would take place, and in several instances, in trying to pull this reamer back out of the hole, to reset it, the lugs would become wedged

(Testimony of Thomas J. Griffin.)

or jammed, sticking the reamer in the hole, and having to pull the string of casing and the tool out. This Swan underreamer is nothing more than an inverted drive-down spear. There is no tilting or releasing-action upon the lugs—they remain stationary in a plane, moving only upwardly and downwardly, and are controlled by the spring-actuated rod. There being no slotted extensions which these bits work through, no tilting movement of the bits, no spreading of the bearing over which the cutters travel or work, I fail to find any comparison whatever in the Swan reamer with the Double and Wilson.

Q. 483. You have stated that this locking device in this Swan patent, and sample of Swan reamer, is depended upon to lock the spring-actuated rod in its lowermost position, permitting the bits to remain at the bottom end of the body. In what other exhibit do you find a similar locking device or a locking device for a similar purpose?

A. I find a similar locking device to the Swan in the O'Donnell & Willard; also in the North and the Kellerman.

Q. 484. From your experience with underreamers, Mr. Griffin, what have you to say as to the practicability of any underreamer which depends on a locking device for this purpose? A. They are useless.

Q. 485. Do you mean the locking device is useless or the underreamer?

A. The underreamer and the locking device both. I have never known of a single one that could be practically operated.

(Testimony of Thomas J. Griffin.)

Q. 486. Referring again to this Swan reamer, either as [500] exemplified in the Swan patent or the exhibit sample of Swan reamer, in what manner are the bits induced to spread out or expand?

A. An upwardly and outwardly inclined wedge, working in conjunction with the tension on the spring-actuated rod, with the key holding the cutters.

Q. 487. And what holds the cutters on this wedge?

A. Grooves or planes.

Q. 488. Are these what are referred to in the patent as the ways A7? A. Yes, sir.

Q. 489. These are the parts that have been referred to by William W. Wilson in his testimony, as dovetails, are they not? A. Yes, sir.

Q. 490. Have they any correspondence with the dovetails in the Double or Wilson underreamer?

A. Absolutely none.

In a conversation I heard between Mr. Tom O'Donnell and Thomas Crumpton in Coalinga in 1908 or the spring of 1909, Mr. O'Donnell asked Crumpton what he had done with the reamer. He stated that he had run it into the hole, kept it there a few minutes and when he pulled it out, found "the guts of the damn thing was in the hole." O'Donnell said, "Go ahead, I knew the damn thing was no account," and it was only another experiment. It is mine and is paid for [501] do whatever you please with it.

Cross-examination.

(By Mr. BLAKESLEE.)

Q. 498. Mr. Griffin, in "Complainants' Exhibit

(Testimony of Thomas J. Griffin.)

Wilson Underreamer," and Wilson Underreamer No. 2" will you please point out to me a hollow slotted extension at the lower end of the body of each of these exhibits?

A. I will. That is the hollow slotted extension. Mr. Blakeslee— Witness pointing to the space between what have been termed prongs at the lower end of the body of "Complainants' Exhibit Wilson Underreamer Number 2."

Mr. LYON.—I object to that. The witness did not point to the space, but he drew his foot from the bottom of the body of "Complainants' Exhibit Wilson Underreamer Number 2," to the top of the slot there through, evidently including the portion thus covered by his foot.

Mr. BLAKESLEE.—I object to this statement of what the witness did, in that it designates the opening as "slot."

Mr. LYON.—Well, ask the witness to state it in the record.

Q. 499. (By Mr. BLAKESLEE.) Will you, then, please, Mr. Griffin, define this alleged hollow slotted extension in the exhibit, by describing the exhibit as to its tangible portions, related structurally to such alleged hollow slotted extension?

A. First, by saying that this is a body of an underreamer mandrel, it having a hollow portion having been bored out, making it hollow, by placing it under a planer or milling machine, and milling a slot, beginning at the lower portion or end, upwardly about

(Testimony of Thomas J. Griffin.)

11 inches, and being about two inches wide, through from one periphery to the other, forming a slot.

Q. 500. Will you please give us your definition of a slot?

A. A slot is an opening that is cut out to receive some [502] other part, or to set over something, with an opening from one side to the other.

Q. 501. I now call your attention to an opening in the body of "Complainants' Exhibit Wilson Underreamer Number 2," just above the thrust-bearing at one side, where the upper end of the shank of one of the cutters bears against the body at that side, and will ask you to please define that opening?

A. I don't find the cutters striking against any such shoulders. The upper end of the shank of the cutters strikes against a shoulder, that is, in the upper part of the slotted extension.

Q. 502. Is the opening which I have referred to in the last previous question made clear to you as to its location?

A. I think not. If I have not answered it as you so desire, if you will explain it to me more fully I may understand it.

Q. 503. Well, I now place my pencil in an opening in the side of the body of this exhibit, just above the shoulder which is engaged by the upper end of the shank of the cutter at that side of this exhibit, and will ask you to please tell me what kind of an opening that is? A. That is a key-way.

Q. 504. Is it a slot?

A. It might be termed a slot.

(Testimony of Thomas J. Griffin.)

Q. 505. It has continuous, unbroken walls, has it not?

A. One way of speaking, it has; another way of speaking, it has not, as the walls are broken on the inside.

Q. 506. It has one continuous wall, has it not, extending around its sides and its ends, without a break? A. On its outer surface, yes.

Q. 507. The opening which you have referred to at the lower end of the body of this exhibit has no continuous wall extending [503] around it, to include both the ends and sides, has it?

A. As it is now, no. (Indicating.) As it now is, yes. (Indicating.)

Mr. LYON.—Just put in the record what you have done.

Mr. BLAKESLEE.—Witness inserts a retaining bolt at the lower end or adjacent to the lower end of the opening referred to, which was previously not in its position. This retaining bolt, of course, is in no way a part of the body, or integral part, is it?

A. Yes, sir; it is.

Q. 508. It is an integral part?

A. I don't know just what you mean by integral. It is a necessary part of the body.

Q. 509. It was not there when the opening was made, was it? A. It was not.

Q. 510. Now, which of these two openings just referred to, the lower or the upper, do you consider most properly as forming a slot?

A. The lower one.

(Testimony of Thomas J. Griffin.)

Q. 511. And for what reason?

A. For the reason that it has the elongated key-way cut in the body just above the bearing, thrust-bearing, which is just wide enough for the key to pass through, making it a key-way—just room enough in it for pushing in easily. If it had been made deeper then it might have been called an elongated slot.

Q. 512. Then, I take it, that whether a given opening is a slot or not, depends on the length, and also upon the dimensions of the part that fits into it, does it?

A. Well, if it was a long opening that was taken out, as, for instance, a strap on an engine crank pin, where a gib and a key is used, you might call it a slot; but there is no such thing [504] in this body; that is simply plainly a key-way, cut through sufficiently large to allow the key to enter.

Mr. BLAKESLEE.—I will ask the Examiner to read the question, please.

(Last question read by the Special Examiner.)

Q. 513. Please answer this question yes or no, and then make such further statement as you may wish.

A. Read the question again.

(Last question again read by the Special Examiner.)

A. No, this is not necessary. The word “slot” and “key” has been made to fit the person making the application.

Q. 514. Please state which of these two openings referred to in the lower end of the body of this ex-

(Testimony of Thomas J. Griffin.)

hibit most resembles the opening through the extension at the lower end of the body, "Complainants' Exhibit" or "Defendant's Exhibit Double Underreamer," such opening being confined entirely by the flat faces of such extension.

Mr. LYON.—The question is objected to as incorrectly defining the structure referred to.

Q. 515. (By Mr. BLAKESLEE.) Now, answer please. A. Please read the question.

(Last question read by the Special Examiner.)

A. I now state that the Wilson compares to the Double. With the bolt inserted through the slotted extension of the Wilson reamer, forms the integral part of the lower portion of the Double.

Mr. BLAKESLEE.—Please read that question, and I will ask the witness to answer it in terms.

(Last question again read by the Special Examiner.)

Mr. LYON.—The question is again objected to upon the ground stated in the preceding objection, counsel in his question having [505] disregarded the structure of the Double underreamer.

A. Now, what is that question, once more.

Q. 516. (By Mr. BLAKESLEE.) In order to more technically meet the objection of counsel to this question, if he wishes the question doctored as to technicalities for presentation to the witness, I will ask the question to be re-read, with the word "planes of the" inserted before the words "flat faces." Please re-read the question, so altered.

Mr. LYON.—Same objection noted.

(Testimony of Thomas J. Griffin.)

(Last question read by the Special Examiner as amended.)

A. Both.

A. 517. (By Mr. BLAKESLEE.) Then, I take it that you must mean to tell us that both of said openings referred to, adjacent to the lower end of body of "Complainants' Exhibit Double Underreamer" or "Defendant's Exhibit Double Underreamer," are the same kind, fall within the same definition; is that correct?

Mr. LYON.—Haven't you switched your exhibits?

Mr. BLAKESLEE.—Yes, I have,—“Complainants' Exhibit Wilson Underreamer” and “Complainants' Exhibit Wilson Underreamer Number 2,” instead of Double.

A. Now, what is my answer to that?

Mr. LYON.—You haven't answered it yet.

Mr. BLAKESLEE.—Your answer was “both” to the previous question.

A. Both; as the Double has a slotted extension extending from one periphery to the other; and “Complainants' Exhibit Wilson Underreamer Number 2” has a similar slotted extension, extending from one periphery to the other.

Q. 518. In “Complainants' Exhibit Wilson Underreamer Number 2,” which of the openings, the lower opening or the opening in the side just above it, most resembles the elongated opening [506] in the extension at the lower end of “Complainants' Exhibit Double Underreamer” or “Defendant's Exhibit Double Underreamer,” such opening being confined

(Testimony of Thomas J. Griffin.)

between the parallel planes of the flat faces at the sides of such extension?

Mr. LYON.—Objected to, as the question does not correctly state the structure of the Double exhibit referred to.

A. I will say that there is no comparison between these two. The key-way in the body of the Wilson is plainly a key-way, for a different purpose, and performs a different function to the slotted extension of the Double.

Q. 519. (By Mr. BLAKESLEE.) Then you see no similarity, do you, between either of these openings referred to, adjacent to the lower end of “Complainants’ Exhibit Wilson Underreamer Number 2,” and the elongated opening in the extension at the lower end of the body of “Complainants’ Exhibit Double Underreamer” or “Defendant’s Exhibit Double Underreamer,” such opening being that extending transversely of that extension, and confined between the planes of the flat parallel faces of that extension.

Mr. LYON.—The same objection is urged to this question, as the question eliminates from consideration that portion of the hollow as a large extension of the Double underreamer by which approach is secured to the plain surfaces referred to.

Mr. BLAKESLEE.—Just add there, eliminate for the present purposes, just exactly those spaces by which such approach is obtained.

Mr. LYON.—The question is then objected to as entirely irrelevant, immaterial and futile, as it elimi-

(Testimony of Thomas J. Griffin.)

nates part of the operative features of the hollow slotted extension.

Mr. BLAKESLEE.—Now, read the question, please.

(Last question read by the Special Examiner.)

A. I must take issue with counsel, that it is not confined. [507] The outer portion of the slotted extension has been enlarged for a purpose. There is no such comparison in the Wilson underreamer, “Defendant’s Exhibit Number 2,” and there is no such key-way in the Wilson reamer, “Complainants’ Exhibit Wilson Underreamer.”

Q. 520. Then, neither of these openings, I take it, in “Complainants’ Exhibit Wilson Underreamer Number 2” finds its counterpart in the extension of “Complainants’ Exhibit Double Underreamer” or “Defendant’s Exhibit Double Underreamer”?

A. The counterpart of the slotted extension of Wilson underreamer, compares with the counterpart of the slotted extension of the Double underreamer, with the exception that one is larger than the other—wider.

Mr. LYON.—Just note there that the witness in giving those last answers runs his pencil through the lower end of “Complainants’ Exhibit Wilson Underreamer Number 2,” where the bits or cutters operate, and similarly through the similar part of “Complainants’ Exhibit Double Underreamer.”

Q. 521. (By Mr. BLAKESLEE.) Now, I am not talking at all about extensions in either reamer, as far as masses of metal are concerned. I am talking

(Testimony of Thomas J. Griffin.)

about the openings in such extensions, and I will again ask you to please tell me if you find on "Complainants' Exhibit Double Underreamer" or in "Defendant's Exhibit Double Underreamer," in the extension at the lower end, any such opening in kind as is found adjacent to the lower end of "Complainants' Exhibit Wilson Underreamer Number 2."

Mr. LYON.—I will ask counsel to define what he means in the question by the words "in kind."

(Last question read by the Special Examiner.)

Mr. BLAKESLEE.—Just state, I think the question is clear, and do not wish to further elaborate this interrogatory, but wish the witness to answer it in present form. [508]

A. Mr. Examiner, I shall have to ask counsel to tell me whether he has reference to the portion of the Wilson as directly below the retaining pin, that passes through the slotted extension of the Wilson reamer; and, with that explained to me, I may be able to answer his question.

Q. 522. I refer to the entire opening across which the retaining pin passes or extends, and also and furthermore to the opening I have previously referred to in this exhibit, in the side of the body a little above the upper end of the opening which the retaining pin extends across.

A. Do you mean in this question the key-way that passes through the body of the Wilson reamer, "Complainants' Exhibit Number 2," just above the thrust-bearing, comparing it with the hollow slotted extension of the Double reamer, or do you have refer-

(Testimony of Thomas J. Griffin.)

ence to that portion of the body of the Wilson reamer, "Complainants' Exhibit Number 2," just below the pin and the metal which forms an integral part of the lower portion of the Double?

Q. 523. I will ask the witness to answer the question. I believe that he can understand it. If he cannot, he can say so, and can answer accordingly.

A. I have clearly stated that I did not understand the question; and ask the counsel to explain to me what part of the body he had reference to, and will now ask that the Examiner re-read the original question.

(Question read by the Special Examiner as follows: "Then, neither of these openings, I take it, in "Complainants' Exhibit Wilson Underreamer Number" finds its counterpart in the extension of "Complainants' Exhibit Double Underreamer" or "Defendant's Exhibit Double Underreamer"?)

A. Yes, it finds its counterpart. The counterpart of [509] the slotted extension of the Wilson reamer is identically the counterpart of the slotted extension of the Double.

Q. 533. Is the hollow present in "Complainants' Exhibit Wilson Underreamer" now at the lower end of the body, beneath a transverse plane lying on the shoulders which receive the thrusts from the upper end of the shanks of the cutters?

A. There certainly is the hollow in "Complainants' Exhibit Wilson Underreamer Number 2," also in "Complainants' Exhibit Wilson Underreamer,"

(Testimony of Thomas J. Griffin.)

at the upper end of the thrust-bearings, extending on upwardly in the body.

Q. 534. I will ask the question to be re-read, and answer yes or no.

(Last question read by the Special Examiner.)

A. Yes.

Q. 535. Is there also a slot in the lower end of the body of "Complainants' Exhibit Wilson Underreamer Number 2," beneath the plane which lies in the shoulders which take the thrusts from the upper end of the shanks of the cutters? A. Yes.

Q. 536. Please tell me where the hollow is, and also where the slot is.

A. Why, the hollow is inside the body, and the slot goes through from one periphery to the other.

Q. 537. And the hollow is inside of the body, above the transverse plane which lies on the faces and shoulders of the body which received the up-thrust from the upper ends of the shanks of the cutters, is it not? A. Yes.

Q. 538. Then, below that plane, just referred to, of "Complainants' Exhibit Wilson Underreamer Number 2," there is no hollow, but only a slot, as you define it, is there? [510]

A. I didn't say that. I said that it was a hollow, beginning at the lower portion, which was left optional with the mechanic who was constructing this reamer as to the size of this hollow; and in "Complainants' Exhibit Wilson Underreamer Number 2" there is a hollow below such portion described by counsel.

(Testimony of Thomas J. Griffin.)

Q. 539. And also a slot? A. And also a slot.

Q. 540. Well, please tell me where the hollow begins and ends off, and where the slot begins and ends off.

A. The hollow begins at the lower end of the reamer body, at its spreading point, and continues up into the body sufficiently far to allow a spring and spring-actuated T-rod to be inserted; and the slot begins at the lower end of the reamer, beginning at the extreme points of the spreading-bearing, and continues up for any desired distance that the mechanic constructing this tool desires the cutter shanks to be.

Q. 541. Now, do you find any metal between the hollow and the slot beneath the poane which lies in the lower faces of the shoulders of the body in "Complainants' Exhibit Wilson Underreamer Number 2"?

A. Yes; I do.

Q. 542. Please point out with your finger that metal.

A. This is it. This large portion of the T which carries the cutters, and acts, and is for substantially the same purpose as the metal on the inner shoulders formed by the smaller size slots in the slotted extension of the Double reamer. This portion in the Wilson is removable—

Q. 543. And that T— I think you have testified—

A. Just one moment, please. I haven't got through.

Q. 544. All right.

A. Further I find a removable retaining bolt

(Testimony of Thomas J. Griffin.)

through this [511] body, that is just below the inner faces of the dovetails.

Q. 545. And then, I take it, that that removable pin or retaining pin in between the hollow and the slot in "Complainants' Exhibit Wilson Underreamer Number 2"; is that correct? A. Yes, sir.

Q. 546. And, as I understand your previous testimony, the metal which you have referred to on the spring-actuated rod on "Complainants' Exhibit Wilson Reamer Number 2," namely, the lower end of the rod and its T, perform the same office as the key which supports the cutters in "Complainants' Exhibit Double Underreamer" and "Defendant's Exhibit Double Underreamer." Is that correct?

A. It has two functions. One is the purpose of carrying the inner thrust of the shanks of the cutters, which is the flat parallel surface, which performs the same function as the solid metal portion that is formed by the small or slotted extension, which is a part of the continuation of the hollow slotted extension of the Double; and the other provides a key for the carrying of the cutters up into their position, actuated by the spring.

Q. 547. And the hollow, as you have defined it in the process of forming the opening at the lower end of "Complainants' Exhibit Wilson Underreamer Number 2," would extend directly through the retaining pin of this exhibit and directly through the T, would it not—that is, longitudinally of the reamer?

A. It would not be necessary to remove this retain-

(Testimony of Thomas J. Griffin.)

ing pin to put this hollow slotted extension in the Wilson reamer. That could be very easily placed in there prior to the forming of these hollow slotted extensions, as the hollow is so much larger in the Wilson than in the Double. Simply they could be planed in there, and this retaining bolt remain in position. That would [512] not have to be removed.

Q. 548. Will you please explain to me how you could drill or produce the hole up into the body of "Complainants' Exhibit Wilson Underreamer Number 2," over the lower end of the body, with the retaining pin and the T in place?

A. I didn't say that the T would be in place. Neither did I say that in boring the hollow that the pin was in position. I said that it was not necessary to remove the pin from the lower end of the body to form the hollow slotted extensions, as previously the hole would have been bored in there before you could have inserted the T-spring-actuated rod.

Q. 549. Then, I take it that the retaining pin and the key extend across the hollow in this exhibit, do they not? A. They do.

Q. 550. And also that they extend across the slot in this exhibit, do they not? A. They do.

Q. 551. Now, is there anything which forms—

A. I beg pardon. The key does not extend across the slot; it extends through the slot. But the retaining bolt extends across the slot.

Q. 552. Is there any metal in the hollow or in the slot you have defined, between the retaining pin and

(Testimony of Thomas J. Griffin.)

the T? A. Yes, there is metal there.

Q. 553. And what is it? A. Part of the body.

Q. 554. Now, my question was, in the hollow, not at the sides of the hollow.

A. In the hollow there is none.

Q. 555. Then the slot and the hollow have no defining wall between them, have they, at which you can say the slot commences [513] and the hollow ends? A. I think so.

Q. 556. What is that?

A. Same as shown on the Double,

Q. 557. What?

A. The upper shoulders or the portions formed to receive the upper shoulders, the shoulders of the cutters, is the upper part of the slot, and the retaining bolt is the lowest part of the slot.

Q. 558. And the hollow?

A. Is between the two.

Q. 559. And where is the slot?

A. The slot is from one periphery to the other.

Q. 560. And joins with the hollow?

A. And joins with the hollow. Identically the same with the Double,

Q. 561. And, aside from the T and the retaining bolt, there is nothing in the slot or in the hollow, is there? A. No, sir.

Cross-examination.

(By Mr. BLAKESLEE.)

Q. 562. If, as you have testified, the hollow is first produced in the Wilson underreamer at the lower end, below the shoulders on the body, which receive the

(Testimony of Thomas J. Griffin.)

upthrust from the upper ends of the shanks of the cutters, what becomes of this hollow after the slot is formed?

A. A portion of it in the "Complainants' Exhibit Wilson Underreamer," and "Complainants' Exhibit Wilson Underreamer No. 2," still remains.

Q. 563. Does a portion of it remain beneath the shoulders on the body? [514] A. It does.

Q. 564. How much of it remains beneath those shoulders?

A. Probably from an eighth of an inch to a quarter in depth.

Q. 565. And is that part distinct from the slot?

A. No.

Q. 566. The same space constitutes part of the slot and part of the hollow, does it not?

A. Yes, sir.

Q. 567. Then, in so far as the space entering into the hollow and slot are concerned, that is, the space which is common to both, the hollow and slot throughout that space are one and the same thing, are they not? A. Yes.

Q. 568. Now, I will ask you—

A. Just a moment. I wish to say that this hollow and slot, as referred to, applies to the Double reamer, "Defendant's Exhibit Double Underreamer," and "Complainants' Exhibit Double Underreamer," of the different types that I have testified to in this case, the same as the Wilson.

Q. 569. Now, will you please describe to me carefully the hollow in "Complainants' Exhibit Double

(Testimony of Thomas J. Griffin.)

Underreamer," or "Defendant's Exhibit Double Underreamer," and then describe to me the slot in the same reamers.

A. The hollow in the Double underreamers, "Complainants' Exhibit" and "Defendant's Exhibit Double Underreamer," commences at the lower portion of the body and extends through to the upper end of the mandrel in two sizes, the larger portion of the hollow terminating just above the thrust-bearings of the hollow slotted extension, made of any suitable size to receive the spring and spring-actuated rod, forming a shoulder for the spring; thence passing through the lower portion of the body smaller in [515] diameter. The slot starts from the lower end of the mandrel and extends up to the shoulders and is planed out to a sufficient depth and width to allow the shanks of the cutters to enter, and then milled through into the hollow portion. The tool is then turned over and the milling process and the planing process is continued until the hollow slotted extension is completed, forming one continuous, unbroken slot from the periphery of the tool down and through the slot on the opposite side to the same periphery of the other side of the body. In the forming of this hollow slotted extension the outside or spaces planed in for the receiving of the cutters, go from the end to the shoulder. The central portion of the body then is slotted and the lower part is left intact for the purpose of retaining the key or T spring-actuated rod from coming out if any accident should happen to the reamer, and is there for

(Testimony of Thomas J. Griffin.)

the purpose of a safety device identically the same as "Complainants' Exhibit Wilson Underreamer" and "Complainants' Exhibit Wilson Underreamer No. 2."

Q. 570. And the hollow in "Complainants' Exhibit" and "Defendant's Exhibit Double Underreamers" in the hollow slotted extension received the lower end of the spring-actuated rod in a close fit and guides it in its play, does it not?

A. Yes, identically the same, and for the same purpose, and the same construction as there is in the Wilson Complainants' Exhibit Underreamer and "Complainants' Exhibit Wilson Underreamer No. 2."

Q. 571. Show me any such construction beneath the shoulders on "Complainants' Exhibit Wilson Underreamer" or "Complainants' Exhibit Wilson Underreamer #2."

A. Before answering the question I will have to modify my previous answer to the extent of the Wilson underreamer—"Complainants' Exhibit Wilson Underreamer"—as the construction [516] of the T-rod is different from "Complainants' Exhibit Wilson Underreamer No. 2." And will now proceed to show to counsel the hollow slotted extension referred to.

Q. 572. Now, Mr. Griffin, remember that I have specified as to the location of this hollow slotted extension, that it is beneath the shoulders which receive the upthrust on the upper ends of the shanks of the cutters.

(Testimony of Thomas J. Griffin.)

A. That is exactly what I understand your words, and therefore I will proceed to show it. If counsel will come here I will show it to him.

Q. 573. I want you to describe it in your own language; the exhibits speak for themselves.

A. The body of "Complainants' Exhibit Wilson Underreamer No. 2" has been bored out and a portion of that bore still remains in the body which forms a hollow, and it has in this exhibit—or in this exhibit still remains a portion of the hollow.

Q. 574. And beneath the shoulders on the body which I have specified?

A. Beneath the shoulders on the body that you have specified.

Q. 575. And is the spring-actuated rod snugly received in that hollow beneath those shoulders?

A. It is a loose working fit.

Q. 576. And as far as that fit is concerned, it is just as loose a fit as if you consider the slot in that Wilson reamer the hollow, is it not? A. No.

Q. 577. Please show me in what manner the hollow fits the rod beneath the shoulders differently from the fit of the slot beneath the shoulders. [517]

A. The hollow is circular in form and the slot is formed across and through the hollow.

Q. 578. And they both have the same side confining walls, have they not?

A. The slot has no confining walls. The hollow has confining walls.

Q. 579. In other words, the slot is an entirely open space with no walls around it, just like part of the middle of a room?

(Testimony of Thomas J. Griffin.)

A. Well, I have described this particular reamer as having a hollow in the center and a portion of the body remains around the hollow.

Q. 580. In other words, I take it the hollow lies in the slot in the same manner that you might consider a smaller bunghole lies within a larger bunghole—is that it?

A. No, there is no bunghole considered in this, and we are not discussing bungholes. We are discussing a hollow; and a hollow might be round or it might be square, in this instance, and originally it was round.

Q. 581. Well, then, please describe definitely what it is, if anything, that separates the slot from the hollow at any point in the Wilson underreamer beneath the shoulders on the body.

A. There is nothing that separates the hollow from the slot.

Q. 582. And then you cannot point out to me, I assume, where the hollow stops and the slot commences?

A. Why, I did not say that. I certainly can point out to you where the hollow starts and the slot commences.

Q. 583. No, where the hollow stops and the slot commences.

A. Where the hollow stops and the slot commences?

Q. 584. Exactly. A. I can. [518]

Q. 585. Please describe that point or region or zone, or whatever else it may be.

A. The hollow starts at the end of the reamer and

(Testimony of Thomas J. Griffin.)

continues up into the body. The slots commence at the end of the reamer and continue up to their shoulder.

Q. 586. You have not yet pointed out to me where the hollow stops and the slot commences. You have admitted that there is no wall or defining separation between the slot and the hollow. Now, please point out where one ends and the other commences.

A. The hollow ends at any suitable distance in the body as the mechanic constructing it sees fit to drill it, and commences at the lower portion of the mandrel. The slot commences at the lower portion of the mandrel and the ends at the shoulders.

Q. 587. And they both utilize the same space, do they not?

A. They both utilize the same space? Partially. They are in the same body.

Q. 588. And there is no metal barrier or wall which marks the place below the shoulder where one ends and the other immediately begins, is there?

A. Not exactly. You put the T-rod in.

Q. 589. And when you have to put in the T-rod, have you separated the slot from the hollow?

A. That would be owing to how you want to construe it.

Q. 590. No, I asked you directly, and I want an answer yes or no as to that; and you may state afterwards, if you wish, anything further.

A. Read the question. (Question No. 589 read.) No.

Q. 591. And when you have put the retaining bolt

(Testimony of Thomas J. Griffin.)

in at the bottom, have you separated the slot from the hollow? A. No. [519]

Q. 592. In either "Complainants' Exhibit Double Underreamer" or "Defendant's Exhibit Double Underreamer," your slot comprises two broader portions connected by a contracted portion, does it not?

A. Yes.

Q. 593. And that contracted portion is in a continuation of the body which goes clear to the lower end of the reamer?

A. I did not say the contracted portion went to the lower end of the reamer.

Q. 594. Read the question again, please. (Question No. 593 read.)

A. I shall have to reply again, I did not say it went to the lower portion of the body.

Q. 595. I asked you if the contracted portion of the slot in the Double reamer does not lie in a portion of the body which goes clear to the bottom of the reamer.

A. That is correct.

Q. 596. And the hollow in the Double underreamer, in either of the said exhibits, beneath the shoulders which receive the thrust from the upper ends of the shanks of the cutters, is entirely confined within this extension of the body through which the contracted portion of the slot is cut, is it not?

A. I will have to say that I do not understand counsel's words or meaning, and ask him to please define what he has reference to.

Q. 597. This portion of this extension of the body clear to the lower end of the body in the Double

(Testimony of Thomas J. Griffin.)

reamer, through which extension the contracted portion of the slot is formed, is borne upon by the cutters at its lower end when the cutters are tilting, is it not?

A. Yes. [520]

Q. 598. And its parallel side faces are borne upon by the cutters at their inner faces, or at the shoulders on their inner faces, during parts of the contracting and expanding movements of the cutters, are they not?

A. It is owing to what exhibit you have reference to.

Q. 599. In both "Complainants' Exhibit Double Reamer" and "Defendant's Exhibit Double Underreamer"? A. Yes.

During the expansion of Double underreamer cutters they do not engage with the dovetails of the reamer body. The cutters cannot contact with the dovetails when expanding as the casing shoe prevents them from doing so. They may contact or expand without the dovetail, therefore they are not dependent on the dovetails for their contraction or expansion. However, there is a difference in the expansion or contraction of the cutters when they are in working position in the hole. The binding or contact is then against the cutting edge of the cutters, or at lower end of cutters, hence they do tilt out at the upper end so that the cutters then contact against dovetails, when expanding. They also slide upon the key when contracting or expanding. That is I refer to the Double cutters. This sliding upon the key is produced by the upwardly inclined dovetails.

(Testimony of Thomas J. Griffin.)

So that the dovetails of the Double underreamer cutters contact with the upwardly and inwardly inclined dovetails on the reamer body when contracting or expanding when in actual reaming operation. However, that is not the case when contracting when being withdrawn into the casing.

Q. 621. There is a portion of the expanding movement of the cutters when the shoulders on the inner faces of the cutters are in engagement with the parallel flat faces of the hollow slotted extension, is there not? [521] A. Yes.

Q. 622. And what is it that causes the tilting action of the cutters during that part of their expansion?

A. The slipping up over the end of the mandrel.

Q. 623. Is that all?

A. I think so. I think that answers the question.

Q. 624. I am now referring to that portion of the expanding movement of the cutters when the shoulders are up above the lower tapered portion of the mandrel, or hollow slotted extension, so that those shoulders engage with the parallel flat faces of the hollow slotted extension, is there not a continuation of the tilting action of the cutters in their expansion when the shoulders are on those flat parallel faces?

A. Do you have reference to when the tool is operated in a pinched hole, or have you reference to a tool being expanded and contracted in the casing or shoe?

Q. 625. I am referring to the completion of the expanding action under any and all conditions.

A. Well, if the tool is being expanded and contracted normally by going in and out of a shoe, there

(Testimony of Thomas J. Griffin.)

is no such movement; but if the tool is being expanded and contracted owing to the operation of the tools in a hole, and the hole pinching on the ends of the cutters, then the upwardly and inwardly inclined dovetails act upon the cutter and assist it in expanding and allows it to contract, but does not assist it in contracting.

Q. 626. When you gave the answer "correct" to the following question, your answer was wrong, was it not, the question being as follows: Question No. 274: "Then, if I understand you correctly, so far as the expansion of the cutters is concerned the inclination or taper of the dovetails has nothing to do with the expansion of the bits or the mode of their co-operation with the [522] body of the reamer in such expansion?"

A. That answer is correct, and I meant what I said, and I wish to go on record and say that counsel did not define whether he was in normal expanding and contracting those tools or whether he had them in the well in a pinched condition; and in other previous answers to that same question I have defined it as being a separate and distinct mode of operation.

Q. 627. And in the expansion and contraction of the cutters when the underreamer is out of the hole, or an expansion and contraction of the cutters of this same Double underreamer, when it is in the hole beneath the shoe on the casing, there is nothing to prevent the dovetails on the cutters from engaging with the upwardly and inwardly inclined dovetails on the hollow slotted extension, is there?

(Testimony of Thomas J. Griffin.)

A. No, there is nothing to prevent them.

Q. 628. And if they do so interengage, these upwardly and inwardly inclined dovetails on the hollow slotted extension must assist in *in* the tilting of the Double cutters, must they not? A. No.

Q. 629. And why?

A. Because it is not necessary, for the pressure brought to bear upon the points of the cutters. The points of the cutters do not strike, and it will expand and contract over that body there without any dovetails.

Q. 630. Is there anything to keep the dovetails out of interengagement?

A. No, neither is there anything there to keep them in engagement.

Q. 631. What limits the outward swing of the upward ends of the shanks of the Double cutters when they are being expanded irrespective of the shoe, leaving that out of consideration? [523]

A. There is nothing except the tension of the spring and the key.

Q. 632. And the upper ends of the shanks of the cutters slide on the key, do they not?

A. No, not normally.

Q. 633. Leaving the shoe out of consideration.

A. And in answer to that I shall have to say no, not normally; but in pinching, yes.

Q. 634. Now, if the upper ends of the shanks do not slide on the key, how do the cutters tilt at all?

A. They do not tilt. They roll. Or tilt, either, as you desire the answer, either one.

(Testimony of Thomas J. Griffin.)

Q. 635. Then in tilting, the upper ends of the cutters must move inwardly and outwardly along the key, do they not?

A. The upper ends of the cutters do tilt inwardly and outwardly.

Q. 636. And where they engage with the key they move inwardly and outwardly along the key, do they not?

A. Where the fulcrum comes on the key in the slot, from that point upward to the upper end of the shank, they tilt inwardly and outwardly.

Q. 637. Now, is that the only fulcrum employed in the tilting of the cutters of the Double underreamer?

A. Yes, unless you want to call the spreading-bearing a fulcrum.

Q. 638. Is there not a fulcrum at each of the shoulders on the inner faces of the cutters?

A. No.

Q. 639. Isn't there a center of tilt or oscillation at the shoulder of each of the cutters when that shoulder is causing the expansion or contraction of the cutter? [524]

A. There is no oscillation.

Q. 640. There is no oscillation at those shoulders?

A. No, there is no oscillation, if I understand the word oscillation.

Q. 641. Does not the lower end of the cutter swing inwardly, that is, the portion below the shoulder on the cutter? A. That is correct.

Q. 642. And does not the upper end of the cutter swing outwardly, that is, the portion that is above

(Testimony of Thomas J. Griffin.)

the shoulder on the cutter?

A. It is a tilting movement.

Q. 643. Just a moment. I am not through yet. In the contraction of the cutter.

A. That is a tilting or teetering motion, but no oscillation.

Q. 644. Where is the center of that tilting or teetering motion?

A. Hinged upon the key; centered upon the key.

Q. 645. And there is no fulcrum between the part of the cutter which tilts outwardly and the part of the cutter which tilts inwardly?

A. There is a shoulder.

Q. 646. Isn't there a fulcrum upon it at that shoulder? A. Yes, if you wish to call it that.

Q. 647. Now, if there is such a fulcrum upon that shoulder and the lower end of the cutter swings inwardly, with that fulcrum as a center, and the upper end of the cutters swings outwardly with that fulcrum as a center, must not the upper end of the cutter travel outwardly along the key which supports it?

A. No and yes. The upper end of the cutter, as I have before stated, above the key tilts outwardly, and the lower portion tilts [525] inwardly; and in normal expanding it has no sliding movement on the key perceptible.

Q. 648. I will ask that that question be re-read. (Last question read.)

A. No, not along on the key.

Q. 649. In other words, it stays stationary on the key, does it?

(Testimony of Thomas J. Griffin.)

A. In its normal condition, normal expanding and contraction, yes.

Q. 650. It stays stationary on the key at the same time that it moves outwardly, does it; that is, the upper end of the cutter?

A. I have not said it did not tilt. I have said it tilted.

Q. 651. I am not asking about tilting. I am asking about an actual movement away from the center of the spring-actuated rod. Is there not such an actual outward movement of the upper end of the cutter when the cutter is tilting on the shoulder or its inner face as a fulcrum?

A. Unless I have answered this question I shall have to say that I do not know how to answer it.

Q. 652. That is sufficient of an answer if that is the best you can give. Now, in the commencement of the collapsing action of the cutters in the Wilson underreamer, in either "Complainants' Exhibit Wilson Underreamer," or "Complainants' Exhibit Wilson Underreamer No. 2," there is a movement of the shoulders on the cutters downward over inwardly inclined surfaces, is there not? A. Yes.

Q. 653. In the commencement of the collapsing action of the cutters, the Double underreamer, in either Complainants' Exhibit Double Underreamer" or "Defendant's Exhibit Double Underreamer," cutters over any downwardly and inwardly inclined [526] is there any movement of any portion of the surface?

A. I shall have to ask you to define whether you

(Testimony of Thomas J. Griffin.)

mean in actual working conditions or whether expanding normally or not.

Q. 654. Under any conditions whatsoever.

A. On the Wilson underreamer there is a tendency under any condition for the points of the bits to begin to come together, contract, as soon as they start down this incline, owing to the taper bearing which is mechanically speaking, for the same purpose as the upwardly and inwardly inclined dovetails of the Double, you have the motion in the Double if you desire it.

Q. 655. In the Wilson the bearing shoulders on the cutters always engage with the downwardly and inwardly inclined upper spreading-surfaces, so that there is a positive production of a tilting action at the commencement of the collapsing, is there not?

A. In the Double or Wilson?

Q. 656. In the Wilson. A. Oh, yes.

Q. 657. Please point out to me in the Double underreamer, in either of the exhibits, complainants' or defendant's, any such downwardly and inwardly inclined surfaces with which the cutters coengage at the very commencement of the collapsing action of the cutters.

A. There is no such on the Double that forces the contraction of the points of the cutters. It is there, if you want it.

Q. 658. Then, the mechanical construction of the two reamers, the Double and Wilson, in this respect is different, is it not?

A. No. They are simply two inverted—one angle

(Testimony of Thomas J. Griffin.)

in one way, and the other one the other; the opposite, rather. [527]

Q. 659. Referring to the inwardly inclined cut-away portions at the upper ends of the shanks of the Wilson underreamer, do these engage with any inclined surfaces to cause a tilting action of the cutters?

A. They do not engage in any inclined surfaces, but if they were not there the Wilson underreamer would not contract.

Q. 660. But the contraction is entirely caused by the movement of the side shoulders on the cutters over the inclined surfaces of the lower end of the body of the Wilson underreamer, entirely beneath the dovetails, is it not?

A. It is allowable owing to the fact that the upper end of the shank, the dovetails of the shank, of the Wilson cutter, being cut away.

Q. 661. I will ask the question to be read and answered.

(Last question read.)

A. Yes, they would not contract unless this portion of the cutter had been cut away.

Q. 662. And that cutting away is merely to allow, and not to assist, the tilting action, is it not?

A. Well, if it allowed it, it certainly would assist it; without it it could not; and with it, it can.

Q. 663. Well, then, put it this way, the cutting away of the upper end of the shanks of the Wilson cutters simply allows the tilting and does not cause the tilting of the cutters—is that not correct?

(Testimony of Thomas J. Griffin.)

A. Yes.

Q. 664. And under no circumstances either due to the pinch, or anything else, can the parallel dovetails on the body of the Wilson underreamer cause tilting of the cutters by engagement with the dovetails on the cutters—is that not correct? [528]

A. Yes, that is correct.

Q. 665. Now, you have admitted, I believe, that there is a certain portion of the tilting action of the cutters in Double underreamers produced when the shoulders on the inner faces of the cutters are in engagement with the flat parallel faces on the hollow slotted extensions?

A. Just a moment, I have done nothing of the kind, only under certain circumstances, certain conditions.

Q. 666. Do I take it, then, that all of the tilting of the Double cutters is produced by the engagement of the shoulders with the inwardly inclined faces at the very bottom of the body of the Double reamer?

A. Correct.

Q. 667. And there is normally no tilting action after the shoulders on the inner faces of the cutters have passed from these surfaces onto the flat parallel faces of the hollow slotted extension?

A. When the reamer is expanded and contracted normally there is none.

Q. 668. In other words, while these shoulders pass upwardly over these flat parallel faces there is no tilting action of the cutters in the Double underreamers.

(Testimony of Thomas J. Griffin.)

A. Only when the reamer is being pinched in the hole.

Q. 669. And yet there is nothing to keep the upper ends of the dovetails on the shanks of the Double cutters from the upwardly inwardly inclined portions of the dovetails on the hollow slotted extension? A. Yes, the shoe.

Q. 670. Then, eliminate the shoe from consideration, and consider the operation without the shoe bearing upon the cutters, and what have you to say? [529]

A. Then in that event, if the hole was large enough, the cutters would contract and expand normally and there would be no tilting action.

Q. 671. Now, after the Double cutters have become somewhat worn on their outer faces, do you take it that the shoe still pinches on these cutters in the expanding and contracting actions?

A. I have never said that the shoe pinched on it.

Q. 672. Do you take it that the shoe engages with the outer face of the cutters under those circumstances?

A. At their lower points, no; only the sides or riding surfaces.

Q. 673. Now, when the reamer is in use beneath the shoe, am I to understand that the cutters remain expanded at all times under all conditions, whether working in mud or any other formation? A. No.

Q. 674. To the best of your understanding, there is a repeated contraction and expansion of the cutters under those circumstances beneath the shoe, is there

(Testimony of Thomas J. Griffin.)

not? A. As the bind comes onto the cutters, yes.

Q. 675. A bind on what?

A. The bind of the walls—binding against the walls or the mud thickens up very thick and dry.

Q. 676. And under those circumstances there is nothing to keep the upper ends of the dovetails on the shanks out of engagement with the upwardly and inwardly inclined dovetails on the hollow slotted extension, is there?

A. They certainly become engaged at that time.

Q. 677. And that being so, while the shoulders on the inner faces of the cutters are riding over the flat parallel faces of the sides of the hollow slotted extension, in Double underreamer, with the upper ends of the dovetails on the shanks of the cutters in engagement with the upwardly and inwardly inclined [530] dovetails on the hollow slotted extension, a tilting action of the cutters takes place, does it not? A. It does.

Q. 678. In both contracting and expanding; is that not so? A. It does.

Q. 682. But the interengaging dovetails on the cutters of the body do not cause this tilting action under these circumstances in the Wilson underreamer, do they? A. No.

Q. 683. And what you have referred to in the operation of the Wilson underreamer, like "Complainants' Exhibit Wilson Underreamer," cannot take place in the use of the Wilson underreamer like "Complainants' Exhibit Wilson Underreamer No. 2," can it? A. No, only partially.

(Testimony of Thomas J. Griffin.)

Q. 684. Then, I take it that all of the expansion and contraction of the cutters in Wilson's underreamer of either type is caused by the engagement of the shoulders on the sides of the cutters with the two sets of inclined spreading surfaces, the upper and lower; is that not correct? A. No.

Q. 685. What else is there in the Wilson underreamer that causes this tilting action of the cutters?

A. The spreading-bearing.

Q. 686. And where is that?

A. At the lower portion of the body.

Q. 687. That is exactly the part that I have referred to, namely, the spreading-bearing which includes the upper pair of slightly outwardly and upwardly inclined spreading-surfaces, and the lower pair of sharply upwardly and outwardly spreading-surfaces. Now, these two pairs of spreading-surfaces cause all the tilting of the cutters in the Wilson underreamer, do they not? [531] A. Yes.

Q. 688. And the dovetails on the body of the Wilson underreamer do not enter into the causing of the tilting of the cutters at all? A. No.

Q. 689. Then, do you not consider that there is a difference in the method of operation of the Double and Wilson underreamers in these respects?

A. None whatever. Mechanically speaking, they are identical.

Q. 690. Mechanically speaking, they are identical in spite of the mechanical differences; is that correct?

A. I do not see any mechanical differences. There

(Testimony of Thomas J. Griffin.)

is a slight difference in the degrees and angles and points that they are situated, but mechanically they are the same and have the same action.

Q. 691. And in their manner of performance are they the same? A. They perform the same work, yes.

Q. 692. But they don't work the same way?

A. With the exception of the action that we have just been discussing they work the same way; that is, the sliding down the downwardly inclined ways of the Wilson and the tilting action of the Double.

Q. 723. Now, in the use of the Double underreamer, like "Complainants' Exhibit Double Underreamer," the laterally projecting shoulders on the cutters do not normally engage with the inclined surfaces of the dovetail notches at the sides of the body, do they?

A. No.

Q. 724. Can they so engage with these surfaces unless the cutter itself bends? [532] A. Yes.

Q. 725. And how?

A. By being driven up into the body or the end of the shank becoming battered down, allowing it to be engaged.

Q. 726. In other words, the shank or the cutter must be mutilated or changed in formation in order for these surfaces, these inclined surfaces of the V-shaped notches, to be of any service; is that correct? A. Either that or bent.

Q. 727. And normally they cannot act as preventers to prevent—oppose any movement of the cutters outwardly? A. No.

(Testimony of Thomas J. Griffin.)

For fifteen or sixteen months I have been associated with Mr. Edward Double. I have several patents pending in which Mr. Double is interested. One of them relates to underreamers.

Q. 737. And have you not some sort of an understanding with Mr. Double that the exploitation or marketing of this underreamer will depend somewhat upon the success of the complainants in this suit?

A. Positively no; it has nothing to do with it, and I never knew anything about this suit until last October, about the 13th to the 20th; and neither has Mr. Double ever solicited me in any way, shape, form, or fashion, to testify in this case. I have not been employed by Mr. Double so to do; neither does my invention in anything pertain in any way, form or fashion, to defendant's underreamer, nor has it any part of that underreamer embodied therein.

Yes, I am receiving pay from Mr. Lyon (counsel of this suit) for my services. I am receiving only three dollars a day and expenses for my testimony. I receive pay from no other source for my service in connection with this suit. I expect to receive pay from no other source. With one exception there are [533] no prospects in my engaging in business with Mr. Double.

Q. 759. And any tendency of the cutters to spread, due to the action of any agency causing—tending to wedge them apart, cannot be taken up by the engagement of the shoulders at the sides of the cutters with the V-shaped notches, can it?

A. First, the shoulders engage with the—or the

(Testimony of Thomas J. Griffin.)

dovetails, rather, engaging with the dovetails of the cutters take up the initial part of the spreading-action, and if it bends or has a tendency to rip, the V-shaped notches then come into contact.

Q. 760. In other words, there must be a bend in the cutter or an actual ripping before this engagement takes place?

A. Before such action the cutter may become bent, or the dovetails on the body of the reamer, or the dovetails on the cutter, may become bent or disarranged; in that event, the notches would come into contact.

Thus they cannot prevent spreading of cutters.

It is not the intent, as I understand it, that any of the up-thrust of the Double improved cutters be taken by this V-shaped notch.

Q. 764. Then, in such a new underreamer, the only thrust that could be taken up by the side surfaces of the body at the lower end is the in-thrust of the cutters; is that not correct? A. That is correct.

Q. 765. And that is the same thrust which is taken from the cutters of "Complainants' Exhibit Wilson Underreamer No. 2" in the upper inclined spreading-surfaces, is that not correct?

A. Yes, that is correct.

In my experience I have never bent a cutter of the Double underreamer, never had the cutters bend outwardly. From my experience these V-shaped notches would very infrequently come into service, if at all, from such binding of the cutters. [534]

I have seen Double underreamers broken in every

(Testimony of Thomas J. Griffin.)

conceivable place that a reamer could be broken in, I presume, and bent. I have seen Double cutters bent. I never saw a Wilson underreamer cutter bent outwardly. It would hardly be possible to bend outward the cutters of the Wilson underreamer under normal condition to be met with, because of its extreme thickness of shanks.

Now the Double Cutter, because of its very construction, is more likely to bend in the shank than the Wilson cutter. The V-shaped groove at the back of the Double cutters gives it a greater tendency to bend the cutters than that of the cutters of the Wilson. This frequently causes breakage of the Double cutters.

Q. 790. Your answers to Questions 310 to 315, inclusive, in disagreement with Mr. E. C. Wilson's testimony, that the extension of the spreading-bearings and thrust-bearings in "Complainants' Exhibit Double Underreamer," transfers the fulcrum from the point of contact further down on the cutters, is summed up in a denial of Mr. Wilson's testimony. Will you please state your reasons for this disagreement with his testimony as to the shifting of this fulcrum point?

Mr. LYON.—I submit to this witness the transcript of the record so far as you referred to it.

Mr. BLAKESLEE.—Here are the questions right here.

A. This fulcrum has not been shifted. It is in the same position in the alleged old type and in the new type.

(Testimony of Thomas J. Griffin.)

Q. 791. In the new type of Double underreamer cutters, is not the fulcrum at the shoulders on the inner faces of the cutters in a line transversely of the cutters and extending across the lateral extensions on the cutters?

A. That is a fact; the cutter has been made wider; but that has nothing to do with changing the position of the fulcrum up [535] or down.

Q. 792. Well, isn't the fulcrum in the improved cutter at this widened portion of the cutter?

A. Yes.

Q. 793. And that widened portion of the cutter is at the lower portion of the inwardly projecting shoulders, is it not?

A. It has nothing in common to do with the V-shaped shoulders. The point of fulcrum has not been changed at all.

Q. 794. I will ask that the question be read, that the witness may again have an opportunity to answer it. (Last question read.) A. Yes.

Q. 795. And the corresponding fulcrum point, or fulcrum area, upon the hollow-slotted extension at the lower end thereof, is arranged in the main further down below the dovetails than it was in "Defendant's Exhibit Double Underreamer"?

A. No, it has not been changed. There has been or is cut away a portion of the upwardly and inwardly inclined dovetail ways a V-shaped notch, which has not changed the fulcrum. Read that question. (Last question read.) If any at all, not more than one-sixteenth of an inch difference.

(Testimony of Thomas J. Griffin.)

Q. 796. Then the inwardly inclined spreading-surfaces at the lower end of the hollow-slotted extension of the Double underreamer are further below the lower ends of the dovetails on the body than they were in the original Double underreamer like "Defendant's Exhibit Double Underreamer"; is that not so?

A. No. Not more than one-sixteenth of an inch, if any at all. I desire to change that answer just the least bit, modify it. Owing to the size and type of the different reamers there may be a small variation, and such might be the case in other sizes. [536] When I made my answer I had reference to the 4 $\frac{1}{2}$ inch improved Double underreamer.

Q. 797. Then, in a 10-inch Double underreamer, approximately how much change would there be?

A. I could not say, as I never put the instrument on it to test it.

Q. 798. It would be more than a sixteenth, would it not?

A. I don't know. I don't know whether it would be one way or the other; it might be more; it might be less.

Q. 799. So when you testified you did not agree with Mr. Wilson; you were merely guessing at the condition; is that it? A. No, I have not guessed.

Q. 800. You simply did not know; is that it?

A. I only stated facts.

Q. 801. Which are not in accordance with the facts that you have just demonstrated, I take it?

A. Which are facts as regards the 4 $\frac{1}{2}$ inch Double

(Testimony of Thomas J. Griffin.)

underreamer which you had reference to; and I simply made this modification, that there was another style and size of reamer in front of me which you had no reference to when you asked the question.

Q. 806. In the old style Double cutters there was nothing extending beyond the sides of the shanks of the cutters to prevent such rotary movement with the exception of the dovetails; is that not so?

A. Why, I think you are correct, as the dovetail was the limit of the bearing on the inner faces of the cutters.

In "Complainants' Exhibit Double Underreamer With a Large Slot," I did not remove the slot; however, I did remove all the hollow. The hollow-slotted extension is still there.

It would be impossible to obtain expansion or contraction of the cutters in "Complainant's Exhibit Double Underreamer With Enlarged Slot" if the spreading-surfaces at the bottom of the [537] body were all removed.

With the "Defendant's Exhibit Double Underreamer" and with "Complainant's Exhibit Double Underreamer With Enlarged Slot" should the spreading portion of the surfaces of the lower end of the body be removed such reamers would be entirely inoperative.

Q. 816. I will now ask you if it would be possible to obtain any expansion or contraction of the cutters in "Complainants' Exhibit Double Underreamer With Enlarged Slot" if the spreading surfaces at the bottom of the body were removed?

(Testimony of Thomas J. Griffin.)

A. No. If you would remove them you could not get any expansion.

Q. 817. And if you removed those spreading surfaces there, you would still have spaced projections at the lower end of the body?

A. No more so in the Double than you would in the Wilson. When you increase the size of the hollow slotted extension in either one, you have destroyed the bearings thereon.

Q. 818. I will now again ask you if you would still not have spaced projections at the bottom of the body of "Complainants' Exhibit Double Underreamer With Enlarged Slot," if you removed those portions of the body at the lower end over which the cutters and the shoulders thereof tilt in expanding and contracting and only those portions?

A. It would have no tilting or expansion effect, as the thinner you get the body of the reamer, the less bearing you would have. Identically the same with the Wilson.

Q. 819. I will give the witness another chance to answer this question, and ask that it be read to him. (The question is read.) A. Yes, sir.

Q. 820. And with those portions of the body so removed, would [538] it be possible to use a cutter like that in "Defendant's Exhibit Double Underreamer" with this "Complainants' Exhibit Double Underreamer With Enlarged Slot"?

A. No; nor no other kind of cutter that could be put on it—such as would go in a well.

Q. 821. In other words, with these spreading por-

(Testimony of Thomas J. Griffin.)

tions of the surfaces of the lower end of the body removed, the reamer as an entirety would be inoperative, would it not?

A. Yes; or any other reamer built upon those lines, and, especially, the Wilson—"Complainants' Exhibit Wilson Reamer No. 2."

Mr. BLAKESLEE.—I will ask that all that latter portion of the answer which commences with "and especially" be stricken out as not responsive to the question.

Q. 822. Now, will you please point out to me in either "Complainants' Exhibit Wilson Underreamer or "Complainants' Exhibit Wilson Underreamer No. 2" where there is any spreading portion or surface at the lower end of the body inward of the inner faces of the spaced projections or prongs with which the cutters coact in tilting?

A. There is none.

Q. 828. What functions would these widened thrust-bearings at the lower end of the body have without widening the cutters to work on them?

A. None.

With "Complainants' Exhibit Double Underreamer With Enlarged Slot," the hollow and the slot are still there. With a small-sized bolt across the lower end there is some of the hollow and some of the slot below the bolt and some of the hollow and some of the slot above the bolt. But if we use the larger bolt that would not be the case. [539]

With the cutters of "Complainants' Exhibit Double Underreamer" all the expanding surfaces

(Testimony of Thomas J. Griffin.)

of the cutters are between the outer edges of the dovetails where with the Wilson the spreading surfaces are arranged laterally of the shanks of the cutters, or outside of the shank of the cutters.

The dovetails of the Wilson underreamer body have more metal in them than is in the Double underreamer. The dovetails of the Wilson underreamer body are stronger than those of the Double underreamer, having more metal and being thicker at their lower portion. But, owing to the construction, the Wilson dovetails will break off as quick, if not quicker, than the Double owing to their peculiar construction. The big unbroken single chamber or space between the prongs of the lower end of the Wilson underreamer body is to be considered as to part of it a slot and as to part of it a hollow.

In regard to my testimony concerning the Kibele reamers or Wilson underreamers belonging to Mr. Jack Kibele which I saw at The Bakersfield Iron Works will say that I was told by the superintendent of the shops and also by himself that all of his reamers were at the Bakersfield Iron Works, hence I testified that all his reamers had had the safety bolt put in them.

I do not know whether these reamers had been remachined or not.

I testified that the Salt Lake Oil Company were using only Double reamers. I did not search through the fields to obtain that information, I simply searched the company's tool rack.

Q. 921. Then you don't know really that they are

(Testimony of Thomas J. Griffin.)

exclusively using the Double underreamer in the so-called Salt Lake field west of the city of Los Angeles?

A. Only what I have been told and what wells I saw in operation. What I have observed while out there on the Salt Lake Company's property, on what I think is known as the [540] Wolfskill Ranch. I saw the Double reamer being used there.

Mr. BLAKESLEE.—In view of the witness' last answer we will ask that his answers to questions 431 and 432 be stricken from the record as being based merely upon hearsay.

Q. 946. Referring to "Complainants' Exhibit Double Patent," I will ask you to point out the parts therein referred to as the hollow slotted extension.

Mr. LYON.—Objected to as not cross-examination, the witness not having been examined with reference to "Complainants' Exhibit Double Patent," the patent in suit; but having been examined solely as a practical expert with relation to the Double underreamers and "Complainants' Exhibit Double Underreamer" and "Defendant's Exhibit Double Underreamer" as they stand.

Mr. BLAKESLEE.—I must call counsel's attention to question 398, and in view of that question I submit that the last question put to this witness is a proper question in cross-examination.

A. In view of the question asked, and my statement before that I had not qualified to examine and pass upon the validity of the Double patent in suit, unless counsel for complainants so requests, I shall

(Testimony of Thomas J. Griffin.)

have to decline to answer the question.

Mr. LYON.—The question is further objected to as not the best evidence; the patent speaks for itself. But the witness is requested to take such time as he desires, and if counsel for defendant insists, examine carefully the drawings of such exhibit [541] and also the description and claims, if counsel for defendant so insists, and answer the question as to his interpretation of the descriptive matter and drawings of said exhibit. He will, however, confine his answers to the descriptive matter and drawings.

Mr. BLAKESLEE.—I will have to ask the witness further if he has not examined this patent as one of the exhibits in this case.

The WITNESS.—I have read over this application, or this patent, once, that is to say, the specifications and probably two or three of the claims.

Mr. BLAKESLEE.—There is no objection to the witness giving such time as he wishes to examine this patent. I am not questioning him as to any matter touching upon its validity, merely as to the plain disclosure of the patent, specification and drawing.

Mr. LYON.—Inasmuch as we have not examined this witness as to any interpretation of the descriptive matter of the Double patent in suit, the exhibit referred to by counsel for the defendant, we insist that the inquiry is not cross-examination, that he is, by pursuing this line of inquiry, making the witness his own, and must be bound by his testimony. If the testimony is in any manner competent, such objection will be understood, as having been taken to

(Testimony of Thomas J. Griffin.)

any other questions addressed to this witness in regard to the meaning or interpretation of the descriptive portion of said exhibit without the necessity of hereinafter repeating the same.

Mr. BLAKESLEE.—We stand upon questions 398 and 399 put to this witness as a proper foundation for the last question, and submit that if the witness was qualified to answer as to the relations of the bits in collapsed position, he is equally qualified [542] to testify as to other parts of the disclosure of this patent. Counsel has certainly opened the door for this inquiry in putting these questions.

A. Now, read that question. (Question No. 946 read.) In Figure IX, in patent No. 734,833, I find by referring to Number 8 on the lower portion of the hollow mandrel or body, commencing at figure 8, and projecting downward to its lower portion, constitutes a portion of the slot. And beginning just below the portion designated as Number 8 I find the slot projecting through that portion of the hollow continues downwardly to any desired length that the mechanic may desire to make it, forming a hollow slotted extension; so that it has an abutment to prevent the rod key or T and cutters from being pulled down and out of the body. In other words, a retaining wall preventing such action. I find that this is hollow throughout its entire length. I find that the slot continues from one periphery to the other, and from one periphery to the central portion of the body into the hollow and the hollow continues to the lower portion of the mandrel, certainly forming a

(Testimony of Thomas J. Griffin.)

hollow slotted extension, beginning at the shoulder, 8, and continuing the full length of that portion of the mandrel.

Q. 947. I note in the specification of the Double patent in suit that the numeral "6" refers to what is called "a downward extension"; and that the numeral "7" refers to what is called a "key-way" in such downward extension. Do you find in this specification any other reference, than by means of the numeral "6," to an extension?

A. I will say that I do not; further that I do not know why the term "key-way" was mentioned in this particular paragraph of the specification, as it is not a key-way; and so cannot be [543] construed by mechanics.

Q. 948. I note further that the specifications state, "17 designates a key in the key seats of the slips and rod and playing in the key-way 7 of said extension." In what way do you take it this key plays in this key-way of the extension?

A. The key-way is there for the purpose of forming a guide, as it is called in this paragraph. For what purpose I don't know, as it is clearly not a key-way, mechanically speaking.

Q. 949. Then, what would you call this opening, 7, referred to as a key-way in the Double patent?

A. A hollow slotted extension, as it is hollow, unquestionably; and it is slotted.

Q. 950. Is there any key in "Complainants' Exhibit Wilson Underreamer" or "Complainants' Exhibit Wilson Underreamer No. 2" which connects

(Testimony of Thomas J. Griffin.)

the cutters with the spring-actuated rod?

A. In "Complainants' Exhibit Wilson Underreamer" there is not. In "Complainants' Exhibit Wilson Underreamer No. 2" there is.

Q. 951. Do I understand you that in "Complainants' Exhibit Wilson Underreamer No. 2," there is a key that connects the cutters with the spring-actuated rod? A. Yes.

Q. 952. Please describe it to me as to its location and connection with the other parts.

A. It is a key-way cut in the body just above the thrust-bearing going through the hollow of the mandrel, passing through a slotted mandrel; and the mandrel, in turn, is made at its lower portion with a crosswise enlargement key or T that the cutters are suspended on. The key that I have reference to works directly in conjunction with the cutters.

Q. 953. Does the key referred to in "Complainants' Exhibit [544] Wilson Underreamer No. 2" at any point touch the cutters in that exhibit?

A. No, they do not touch them.

Q. 956. Now, I note the specification of the Double patent in suit states that the shoulders, 8, are at the sides of such extension, namely, the extension, 6, and that the upwardly and inwardly sloping tapering dovetail slipways, 9, are beneath said shoulders. Will you please point out to me in the specification of the Double patent in suit wherein any reference is made to the connection of these tapering dovetail slipways, 9, with the extension 6?

A. I do not think that the specifications of the pat-

(Testimony of Thomas J. Griffin.)

ent specifically specifies that in those words that you desire, but unquestionably it does.

Q. 957. Unquestionably what does? Please explain that statement.

A. Connect one with the other.

Q. 958. What connects with what?

A. Read the question, Mr. Examiner. (Question No. 956 read.) A portion of the upwardly-inclined dovetails is part of the body; and it, in turn, is a portion of the part of the body which is designated by the figure 6, through which passes the hollow.

Q. 959. And these upwardly-inwardly inclined tapering dovetails, 9, lie in planes which extend at right angles to the opposite flat parallel faces of the extension, 6, do they not? A. They do. [545]

In comparing the "Complainant's Exhibit Double Underreamer" with "Defendant's Exhibit Wilson Underreamer" there appears to be several minor differences which is apparent. When I speak of the projection at the backs of the Wilson reamer cutters which coact with the spreading bearings on the ends of the prongs of the Wilson underreamer, I do not wish to be understood as testifying that any of these spreading surfaces of the cutter project inwardly beyond the inner faces of the cutters. Those projections lie on the inner faces of the cutters, however. However, they do not project inward of the inner faces or the planes of the inner faces of the cutters.

Q. 991. Then, there is no such inward projecting portion of the cutters on the Wilson reamers, is

(Testimony of Thomas J. Griffin.)

there, that is, a portion projecting inward of the faces which can serve as fulcrum points as do the inwardly projecting shoulders on the cutters of the Double reamer?

A. There is no inward projecting shoulders on the Double cutter, no more than there is in the Wilson, but the expanding shoulders are there in the Wilson for substantially the same purpose one with the other.

Q. 992. In the Double reamer cutters, the inner faces are pocketed out, are they not, to produce abrupt shoulders which engage with the spreading-surfaces at the lower portion of the body?

A. The shanks of the cutters have V-shaped notches cut across their inner faces forming a shoulder.

Q. 993. And these shoulders act as I stated in my last question, do they not? A. They do.

Q. 994. Are there any such notches forming any such shoulders in the shanks of the cutters of the Wilson reamer cutters? [546]

A. Yes, but they do not go clear across the inner face of the cutter.

Q. 995. Then, there are no such shoulders formed in the inner faces of the shanks of the cutters of the Wilson underreamer acting as fulcrum points in the swinging action of the cutters, are there?

A. Yes.

Q. 996. In the inner faces of the shanks?

A. On the inner faces of the shank—just excuse me—read that question. (Last question read.) No.

(Testimony of Thomas J. Griffin.)

A fulcrum is a point over which pressure can be exerted, causing a teetering or tilting action and the key that you have referred to, namely, the key to which the Double reamer cutters are suspended, have nothing to do with this fulcrum, and is not a fulcrum. It is simply means for suspension of the cutters allowing them to move upwardly and downwardly in their places.

Q. 1000. In your visit to the property of the Murphey Oil Company of Whittier taken, you say, soon after Mr. Schinneller testified for defendant, did you visit each and every well on that property?

A. No, sir, I don't know where each and every well is located.

Q. 1001. In your answer to question 421 you stated, "I found they were using all Double underreamers." How did you find this out?

A. By asking questions.

Q. 1002. And your information, then, as to the use of the Double reamer on that property simply came from responses you got to questions? A. No.

Q. 1003. How else?

A. I sat here in this office and heard—or in Mr. Raymond I. Blakeslee's office, rather, and heard Mr. Schinneller's [547] testimony that they were using all Double underreamers with the exception of one 4½-inch Plotts reamer, and that they were using that reamer on their deep well. When I went to their deep well—or their lease, rather—I went to the office and asked one of the men in their office where that deep well was, and he pointed it out to me, and

(Testimony of Thomas J. Griffin.)

I went there and saw a 4½-inch Double reamer pulled out of the hole. And if there has been any mistake made it has been made by Mr. Schinneller.

Q. 1004. You did not attempt, then, to find whether this Plotts underreamer was in use on any other well when you visited this property after Mr. Schinneller testified?

A. I did not. I have never used a North reamer nor never saw a North reamer in use. My testimony as to its inoperativeness is simply my conclusion by examining the drawings and hearing the testimony of the other witnesses. By the word inoperative I do not mean that it would not work at all. No, I don't think the North cutters bear against each other when tilting. Although in answering question #440 I stated that the North reamer to be operative should have a partition between the cutters to take the inner thrust of the cutters I will now say that it would be impossible to place such a partition as that between the cutters. I have never used an underreamer like "Defendant's Exhibit Small Model of Day Device." I have never seen an underreamer used or have never used an underreamer like "Defendant's Exhibit Oil Well Supply Company Limited, 4½" Underreamer." I have never seen an underreamer used or never used a reamer "Defendant's Exhibit O'Donnell & Willard Reamer" or "Defendant's Exhibit O'Donnell & Willard Patent."

There is no hollow slotted extension in the O'Donnell & Willard Defendant's Exhibit, nor is there in

(Testimony of Thomas J. Griffin.)

the O'Donnell & Willard Patent. [548]

Q. 1047. In your answer to question 456 you have testified, "I find that there is no thrust-bearings on the shanks of the O'Donnell & Willard Underreamer." Do you wish that answer to stand with relation to the O'Donnell & Willard patent disclosure?

A. No, I do not, as I have just now explained that same question in my previous answer, as in reply to this particular question quoted I had reference to the reamer exhibit.

Q. 1048. And in the structure of the O'Donnell & Willard patent there are shoulders which take the thrust from the upper ends of the shanks of the cutters, are there not?

A. It shows very small shoulders. At their thickest portion might be an inch, circularly speaking, coming to a feather on their edges.

I have never used or seen used an underreamer like "Defendant's Exhibit Kellerman Patent."

Q. 1053. Do not the ways in the Swan underreamer, as shown in "Defendant's Exhibit Sample of Swan Underreamer," and "Defendant's Exhibit Swan Patent," serve to keep the cutters from being displaced sidewise in the same manner as the dovetails in the Double underreamer and in the Wilson underreamer? A. Yes.

Q. 1054. And is there not a hollow slotted extension in the Swan underreamer and also shown in the Swan patent?

A. If you want to term them that, yes. I do not.

(Testimony of Thomas J. Griffin.)

Q. 1055. This part is an extension of the main body, is it not? A. Yes.

Q. 1056. The cutters are mounted to move at either side of the extension of the body, are they not?

A. Yes.

Q. 1057. There is a hollow in this extension through which [549] the spring-actuated rod plays, is there not? A. Partially.

Q. 1058. There is a transverse slot through this extension? A. Yes.

Q. 1059. Through which the T that carries the cutters at the lower end of the rod plays, is there not?

A. There is no T disclosed in this invention.

Q. 1060. What is there in place of the T?

A. A key.

Q. 1061. Well, then, is there not a slot through which this key plays?

A. Yes, but there is no hollow slotted extension, as the hollow does not go through the reamer; therefore, you cannot term it as a hollow.

Q. 1062. There is a hollow in this extension, is there not?

A. There is a hollow in part of the extension.

Q. 1063. Well, let us refer to the exhibits. Is not there a chamber in the body of the Swan underreamer running lengthwise of the body?

A. There is a partial chamber.

Q. 1064. And does not that chamber run down into the slotted extension? A. Yes.

Q. 1065. And does not the slot in the extension run

(Testimony of Thomas J. Griffin.)

transversely through the extension and through this hollow? A. Yes.

Q. 1066. And don't the cutters expand as they move upwardly on this extension?

A. It does, but they do not tilt. They move upward and outward, sliding upon a key.

Q. 1067. I understand you to draw a distinction between an [550] extension on the lower end of the reamer, such as the Double reamer, in which the hollow runs clear to the bottom of the extension, and an extension such as that of the Swan patent and Swan reamer in which the hollow stops a little above the lower end of the extension. Does that make a difference, in your opinion, or within your definition with relation to whether one is a hollow extension and the other is not?

A. It matters not whether it is my opinion or not. The fact remains that this is not a hollow, as you can pass nothing from the upper end through to the lower end. The facts remain the same.

Q. 1068. Then, if there were a hollow between the prongs of the Wilson underreamer and you put a retaining-bolt across it, would not that kill this space as far as its consideration of being a hollow is concerned? A. That is what I have testified to.

The Swan underreamer has what you might call dovetailed retaining ways; yes. In comparing "Defendant's Exhibit O'Donnell & Willard Patent," and "Complainant's Exhibit Double Underreamer Patent" I don't find any difference in the working fits in the spring-actuated rods in the hollows which ac-

(Testimony of Thomas J. Griffin.)

commodate them in their movements in their lower ends.

The slot in the partition in the O'Donnell & Willard reamer and in the O'Donnell & Willard patent runs transversely through the partition crossing this hollow in the partition of the inside, but not extending into the body as in the Double. There is no slot in the body of the O'Donnell & Willard patent, there is no hollow in the partition of the O'Donnell & Willard patent. There is a slot in the partition vertically. If we remove the partition from the O'Donnell & Willard patent the cutters would still expand and contract. [551]

If the inner surfaces of the inner bits or cutters of the O'Donnell & Willard reamer engage with the lower end of the partition, and the bits or cutters are moved upwardly, there is nothing to prevent the partition from causing the lower end of the cutters to expand.

Q. 1114. And if the inner surfaces of the bits or cutters engage with the lower end of the partition, and the bits or cutters are moved upwardly, what is to prevent the partition from causing the lower ends of the cutters to expand?

A. There is nothing to prevent it from expanding.

Q. 1115. That being the case what difference is there between the action of the partition upon the cutters in the expanding of the cutters in the O'Donnell & Willard reamer, at the lower end portion of the partition, and the action of the lower end por-

(Testimony of Thomas J. Griffin.)

tion of the hollow-slotted extension, upon the cutters of the Double reamer?

A. There is no comparison in these two. The action of one does not pertain to the action of the other.

Q. 1116. Point out wherein there is any dissimilarity in the action under these circumstances.

A. Why, there is no tilting action there. It does not come up over a wedge-shaped partition. The inner surfaces of these cutters are parallel. There is no such action in this cutter that there is in the Double; simply a wedge.

Q. 1117. There is nothing to prevent the cutters in the O'Donnell & Willard from tilting in around the lower end of the partition, is there? A. Yes.

Q. 1118. And what?

A. The partition. There is no grooves for this end of the partition to drop into, allowing them to tilt, or to come [552] into such position as I can see. The inner surfaces of the cutters are parallel; so is the partitions outer surfaces parallel.

Q. 1119. You say the outer opposite faces of the partition are parallel?

A. No, I did not say anything about the opposite faces.

Q. 1120. What faces of the partition are parallel?

A. The faces of the partition—the faces on the partition is parallel to the faces of the cutters.

Q. 1121. And the lower end of the partition has its faces rounded or inclined in toward each other, has it not?

A. It has, for the purpose of allowing this tilt-

(Testimony of Thomas J. Griffin.)

ing action, but this is not a titling action. It is a sliding action on the key that brings them in together.

Q. 1122. Yet they tilt around this intermediate partition, do they not?

A. Well, you might term it that.

Q. 1131. And there is a partition between these cutters in the O'Donnell & Willard patent which you do not find between the cutters in the North patent; is that correct? A. Yes.

Mr. BLAKESLEE.—I will ask the witness to please prepare and submit at the next session of taking testimony in this case, or as soon thereafter as he can before the closing of these proceedings, a pen and ink drawing showing the lower portion of the Wilson underreamer. And he may take either "Complainants' Exhibit Wilson Reamer" or "Complainants' Exhibit Wilson Underreamer No. 2" as a guide, with the cutters removed, and with the retaining bolt removed and with the T up as far as it goes in the working of the Wilson underreamer. And indicate on that drawing in black ink such slot as he finds [553] present in the Wilson underreamer at the lower end thereof; and in red ink such hollow as he finds present in the Wilson underreamer at the lower end thereof. And I will ask that this drawing be marked as "Defendant's Exhibit Griffin's Sketch of Part of Wilson Underreamer Illustrating the Alleged Slot and Hollow there Present."

Mr. LYON.—Objected to as incompetent; no foundation laid; and the witness not having quali-

(Testimony of Thomas J. Griffin.)

fied to answer the question, the witness never having testified that he was skilled as a draftsman, or capable himself of making any such drawing as demanded by counsel. And upon the further ground that it is not a proper proceeding nor a proper request.

Mr. BLAKESLEE.—In response we will say, not in argument, but merely as a suggestion, that the witness may have the assistance of such draftsmen as he will choose, to whom he may give his instructions in preparing this sketch.

The WITNESS.—Now, I wish to say that I am not a draftsman; having never testified that I was a draftsman; never having qualified as a draftsman; and that I cannot make any drawings hardly intelligible to myself; and that if counsel for defendants will designate a draftsman, and will pay those expenses which I decline to do out of my own pocket, I will stand over him while he makes those drawings and will show him what I want; otherwise, not being a man of means, I shall have to decline to produce this drawing at my expense.

Mr. BLAKESLEE.—The request still stands without any condition or modification.

Mr. LYON.—Is that the conclusion of the cross-examination?

Mr. BLAKESLEE.—Yes.

When the cutters of the "Defendant's Exhibit O'Donnell [554] and Willard Underreamer" and "Defendant's Exhibit of the O'Donnell and Willard Patent No. 762,435" are in the act of expanding or

(Testimony of Thomas J. Griffin.)

contracting there is no portion of those cutters which contracts with the partition or the removable wedge-shaped partition 3. In that respect the O'Donnell & Willard differs from the Double or the Wilson reamer.

The tapering surfaces or the lugs or projections at the ends of the prongs of the Wilson underreamer body are for the purpose of allowing the cutters to collapse on their initial downward movement. It is also for the purpose of providing inward thrust bearings. These bearings accomplish the same purpose as the upwardly and inwardly inclined dovetails of the Double reamer.

Recross-examination.

(By Mr. BLAKESLEE.)

Q. 1148. You have testified that the upwardly and inwardly inclined dovetails of the Double underreamer only assist in the expanding action of the cutters under certain working conditions but not under all working conditions, I believe; is that not correct?

A. No, sir; I have never testified that the upwardly and inwardly inclined dovetails on the Double reamer assist in the expansion or contraction of the bits. I have testified that the upwardly and inwardly inclined dovetails were there for the purpose of allowing the additional contraction of the bits when they were in pinched form and were there otherwise simply as guides.

Q. 1149. Guides for what?

(Testimony of Thomas J. Griffin.)

A. For the protection or for the prevention of the bits from falling out.

Q. 1150. And acting as such guides, the upper ends of the cutters come in contact with these dovetails, do they not?

A. Not only their upper ends but their lower, also come in contact. [555]

Q. 1151. And if their upper ends are in contact when the cutters are expanding, does it not follow that these upwardly and inwardly inclined dovetails assist in the spreading action of the cutters?

A. If that underreamer is being expanded or contracted through a shoe, the dovetails of the bits never come in contact with the outward or inward sides of the dovetail as it is bound and pressed against the central portion of the body, and it never comes in contact with them until it arrives at its full expansion.

Q. 1152. All right. That is why I tried to carefully draw a distinction for you in construing your previous testimony between those working conditions when the shoe is coacting with the cutters and other working conditions when it is not. Now, in the contraction and expansion of the cutters under other circumstances, as, for instance, when the cutters are beneath the shoe, and the upper ends of the cutters are guided by these upwardly and inwardly inclined dovetails on the body, such contact will assist in the contraction or expansion of the cutters, will it not?

A. It will not unless it is pinched at the bottom

(Testimony of Thomas J. Griffin.)

of the cutting edges of the bits. Then when such is the case, as I have previously testified and defined, both the action of the cutters when working under normal conditions and also when working under abnormal conditions, such as being pinched at their lower ends, and if they were working below the casing in a pinchingly formation, as the ends of the cutters dubbed off and making the hole smaller, gradually smaller, then it would necessarily bind or hold the cutters slightly, causing them to collapse or come down towards the bottom of the reamer, thereby allowing a slight tilting action on the fulcrum point of the spreading bearings, freeing themselves from such a pinched condition. [556]

Q. 1153. And do not the upwardly and inwardly inclined dovetails on the body in the Double reamer actually assist in tilting the cutters when the upper ends of the dovetails of the cutters are under these or other circumstances in contact therewith?

A. In expanding or contracting?

Q. 1154. In either.

A. In the pinched form they simply act as preventers for the cutters, not allowing their upper ends to swing outward, and are there as guides guiding the upper end of the cutter back into its normal position, substantially the same as the slightly beveled portion of the Wilson underreamer, either of their exhibits; simply a matter of angles being inverted or reversed.

Q. 1155. Now, do these dovetails on the body of the Double reamer act as guides, within the mean-

(Testimony of Thomas J. Griffin.)

ing of your last answer, during the movements of the cutters?

A. I will have to ask in what condition, normally expanded and contracted or contracted by being pinched?

Q. 1156. Under any conditions, and you may define them if you wish.

A. As I have stated before—answered that question I don't know how many different times and I have defined it a great many times heretofore; having distinguished the two actions as separate and distinct one from the other, I shall say that the upwardly and inwardly inclined dovetails on the Double reamer when being contracted in a pinched formation, that the upwardly and inwardly inclined dovetails are for the purpose of preventing and in allowing additional space that the cutter may have a slight tilting action on the fulcrum of the body, and that when being contracted and expanded in normal condition there is no engagement of this upwardly and inwardly inclined dovetail until such cutter has arrived at its upward and full movement. [557]

Q. 1157. Now, leave the normal conditions, as you have referred to them, out of consideration, and answer the previous question with respect to any such conditions as you except from the definition of normal.

A. Well, I will have to repeat what I said in my previous answer, that when the cutters are pinched at their lower points they pull down slightly, and at that point they have a slight tendency to slide on

(Testimony of Thomas J. Griffin.)

the key, giving the cutter a tilting movement over the fulcrum of the body; and that they come in contact with the inner surfaces of the upwardly and inwardly inclined dovetails with the surface of the outer dovetail on the cutter, and the play there thus caused by the taper of the upwardly and inwardly inclined dovetail is identically for and is a part of the bottom of the Wilson underreamer, and for the same purpose, and answers the same purpose; and that upwardly and inwardly inclined dovetail has nothing to do with the expansion or contraction of the Double underreamer under any condition. It is there simply as a guide for the upper portion of the cutter.

Q. 1158. I shall have to ask you again whether or not under those conditions which you seem to consider abnormal in the use of the Double underreamer, the upper ends of the dovetails on the cutters of the Double underreamer are not in engagement with the upwardly and inwardly inclined dovetails on the body during part of the movement of the cutters either in collapsion or expansion; and I wish you to answer this question yes or no, and then without referring to the Wilson reamer or any other, make any further statement which you wish to in answer to the question.

A. I do not believe it is in me, or anyone else, to answer counsel's question as he desires. I have stated that the upper ends of the Double cutters come in contact with the upwardly and inwardly inclined dovetails in expansion and contraction under

(Testimony of Thomas J. Griffin.)

[558.] abnormal condition, and I cannot express it in my humble English language any plainer than I have said. And I shall now have to ask counsel not to continue on that line of cross-examination, as I have answered and endeavored to answer this question as fairly as a man can. And this action that I speak of, or these parts that I speak of, have nothing whatever to do with the expansion or contraction of the Double underreamer. They are there for the guidance or guides of the upper ends of the cutters.

Q. 1159. Is that all the answer which you can give or will give to this question?

A. It is not a question of will give. I will give any answer that lays in my capacity, and is correct, the truth, nothing but the truth, and facts, as disclosed in the invention; and I have no other way of differentiating, or answering the question so as to differentiate the answer to the question satisfactorily to counsel.

Q. 1160. I will ask again if that is all you have to say in response to that question. If that is so, we will drop the matter right there.

A. I have said yes.

When the Wilson underreamer is normally operated, there is a spreading or expansion or contraction of the Wilson cutters when they ride over the spreading surfaces upon which the cutters rest when in an expanded position. But when the Double reamer is normally operated the upwardly inclined dovetails on the body do not cause any part of the collapsing

(Testimony of Thomas J. Griffin.)

or expanding action of the Double reamer cutters.

When I speak of the lower end of the partition 3, of the O'Donnell & Willard patent I mean the lower end or the rounded portion.

I don't believe I could say whether the cutters of the O'Donnell & Willard reamer, when they are collapsing and come out of contact with the flat faces of the partition and move [559] down to the rounded end or bear against the rounded end of the partition and in so moving I don't know whether the reamer cutters tilt or not. True, in cut, figure 1, of the O'Donnell & Willard patent it is shown that the upper end of the cutters are tilted or slid outwardly on the key; but I cannot see any tilting action that could have taken place on the T-rod.

It is true that the drawing in the O'Donnell & Willard patent, figure 1, shows that the lower ends of the O'Donnell & Willard cutters have tilted in, and the upper ends of those cutters show that they have slid out on the key.

The action of the O'Donnell & Willard cutter coming in contact with the shoes is at all times below the end of the body, giving the cutters a sliding effect on the key and a slight teetering effect on the removable wedge-shaped partition. This is not the case in the Wilson or the Double, as the casing comes in contact with the shoulder just below the upper end of the shank. There is no surface over which the cutter of the O'Donnell & Willard underreamer ride when expanding or contracting.

Q. 1243. (By Mr. BLAKESLEE.) Now, ad-

(Testimony of Thomas J. Griffin.)

mitting that the partition of the O'Donnell & Willard reamer is a removable part, it is nevertheless an extension or extended part of the reamer down to the bowl and to a point beneath the bowl, is it not?

A. In the same mechanical sense as the Wilson.

Q. 1244. I will have to ask the witness to answer the question Yes or No without any comparison with any other reamer.

A. Read the question. (Question No. 1243 read).
Yes.

Q. 1245. Now, there is a slot running through this extension, through and within which the T, which suspends the cutters, moves, is there not?

A. There is an elongated slot that goes from one flat surface to the other in this removable partition.
[560]

**Testimony of James W. Kelley, Witness Called on
Behalf of Complainants.**

Mr. Kelly deposes and states:

My name is James W. Kelley; that I reside in Victoria, British Columbia, and am a well driller, connected with the Northwestern Company Limited, operating in Alberta, Canada. Have drilled in Ontario and Quebec. Had no use for underreamers in Ontario and Quebec. Wells there are from 2,000 to 3,000 feet in depth. In Alberta the depth of the wells is from 1,800 to 2,200 feet. We used Double reamers in Alberta. Most of our reamers come from the Chicago Works of the Union Tool Company. Mr. Double, I believe, is President of that Company. I know of no other reamers used in

(Testimony of James W. Kelley.)

Canada except the Swan. I have never seen a tool like that shown by "Defendant's Exhibit Oil Well Supply Company's of Canada 41½" Reamer." Have been operating there for five years. We use altogether American made tools. We use cable tools.

In Columbia, South America, we used down there the Swan reamer and the Austrian reamer and the Double reamer. We are now using the Double reamer exclusively. We had trouble in losing the cutters of the Swan underreamer. The Austrian reamer did not drop, that is it did not run free in the hole. I have been around the rigs or wells of the other companies a great deal but I have never seen a reamer like the Canadian underreamer. My opinion of the Canadian underreamer as shown by "Defendant's Exhibit Oil Well Supply Company's Limited on Canada's 41½ Underreamer," is that the cutters are too long and not properly supported. I would not use such a reamer. Our operations in Ontario are probably 150 miles away from Petrolia, Canada. I have been drilling in Canada only during the last five years. My experience in Canada does not go back in 1907. I never used a Wilson underreamer. We did some actual underreaming with the Swan reamers and the Austrian reamers.

[561]

While the Swan reamer and the Austrian reamer were not so successful as the Double still each of them did underream. One trouble with the Austrian and Swan reamers was the breakage of cutters, never lost or broke a Double cutter.

(Testimony of James W. Kelley.)

My operation in Ontario and in Columbia, South America was that of an overseer. I get reports of the work done. I have been on the ground a great deal of the time, myself. I am not sure that I could say I used the Swan underreamer earlier than about three or four years ago. I used the Austrian underreamer about that time. From that on for a couple of years.

Q. 67. Why do you prefer the Double underreamer?

A. Well, we get very satisfactory results with it. It sets perfectly, and trips perfectly; and when it is expanded it is firm and solid; and if the cutters are properly dressed, drops free.

Q. 68. What has the proper dressing of the cutters to do with the underreaming?

A. If the cutters are not properly dressed they will drag in the hole.

Q. 69. How did you come to secure your first Double underreamers?

A. In drilling in Alberta, which was done by the Canadian Pacific, one of my business associates, Mr. Eugene Coste, was the engineer in charge of the work; and he first told me they were having much better success with the Double underreamers than they were with the underreamers which they were using before, which, I think, was the Swan. They had no trouble losing cutters, and they were getting their work along much better, and in my operating in South America, when I first took charge of the [562] operations there, there was an outfit on the

(Testimony of James W. Kelley.)

ground which had been sent in—furnished, I think, by the Oil Well Supply Company. In that outfit there was a Swan and Austrian underreamer. We started up first with the outfit that was on the ground and drilled one shallow well; had considerable trouble; and had been having more or less trouble handling pipe and underreaming and I then began to order exclusively Union Tool Company tools and using exclusively their underreamers. [563]

**Testimony of Arthur P. Knight, Witness on Behalf
of Complainants, in Rebuttal.**

My name is Arthur P. Knight; age, 48 years; resident of Glendale. Occupation, Patent Attorney and Expert.

A. 2. My mechanical training has been mainly as one of the engineering corps at the works of the General Electric Company, Schenectady, New York; and the Thompson-Houston Electrical Company at Lynn, Massachusetts. In addition to this, however, I have been thrown into connection with mechanical work in the course of my business as a patent attorney for a great many years, and have had occasion to examine machinery and to investigate the mechanical principles involved therein.

In the year 1886 until 1889 I was a member of the Examining Corps of the U. S. Patent Office.

A. 5. My duty was to examine applications for United States letters patent with the view to determining whether they complied with the requirements of the law, and whether the alleged inventions dis-

(Testimony of Arthur P. Knight.)

closed therein were of a patentable nature. In order to determine this point it was necessary for me to compare the inventions submitted with the state of the art as disclosed in the prior patents and publications on file in the patent office. As an Assistant Examiner. I am familiar with mechanical drafting.

A. 7. A necessary qualification is the ability to read patent drawings, which are generally of mechanical structures, although not necessarily drawn to scale. In other words, they are drawings of a mechanism, and in that sense are mechanical drawings, although they do not answer all the requirements of an ordinary mechanical drawing.

I have been called as an expert in quite a number of patent suits.

I have examined the Double underreamer patent #734,833, and am familiar with it. I am also familiar with the Wilson underreamer patent and also "Complainant's Exhibit Wilson Underreamer," [564] and "Complainant's Exhibit Wilson Underreamer No. 2." I am also familiar with the Wilson Patent #827,595, dated July 31, 1906. I am familiar with "Complainant's Exhibit Double Underreamer," and with "Defendant's Exhibit Double Underreamer."

A. 14. The Double patent 734,833 relates to an underreamer, that is to say, to a tool which is adapted to be lowered through a well casing and is provided with cutters which are adapted to expand on passing below the lower end of the casing so as to enable the reaming out of the hole below the casing to a suffi-

(Testimony of Arthur P. Knight.)

cient diameter to allow the casing to descend. On account of the thickness of the casing this hole must be reamed to a diameter larger than the inside of the casing, and in order to enable the casing to perform this function and yet permit the tool to be lowered through the hole, it is necessary to so construct the tool that the cutters may be collapsed or contracted while the tool is being passed down through the casing. The construction disclosed in the patent for this purpose consists of or comprises a hollow body provided with a downward extension, in which are mounted tilt slips, said tilt slips being adapted to move or slip vertically and to tilt; and the downward extension of the body being provided with means for engaging the tilt slips to control their collapsing and expanding movement. Said means consists of shoulders or faces on the tilt slips and on the downward extension which engage in the relative sliding movement of the tilt slips to force the lower ends of the tilt slips outwardly as said tilt slips are raised, these lower ends constituting the cutting portions of the tilt slips. The upward slipping movement of the tilt slips is effected by a spring enclosed in the hollow body and bearing against the shoulder thereon, and operating on the rod, 11, carrying a key indicated at 17, which engages in key seats, 16, in the respective tilt slips. Said key seats being large enough to allow the tilt slips to tilt on the key. Shoulders, 8, are provided [565] at the sides of the downward extension forming thrust-bearings against which the upper ends of the tilt slips engage

(Testimony of Arthur P. Knight.)

when in their uppermost or working positions. Slipways are provided on the downward extension of the hollow body between which the tilt slips slip up and down, these slipways furnishing lateral support for the tilt slips; and being provided with dovetails or flanges, and adapted to engage with corresponding dovetails or flanges on the tilt slips when the tilt slips are in working position, to resist any outward strains on the cutters. Above the spreading-bearings, or shoulder portions, the downward extension is provided with bearing faces described in the patent as "oppositely arranged parallel bearing faces" which are adapted to engage with the tilt slips to resist any inward strains of the cutters. The normal or working position of the parts is shown in Figure 1 of the patent. In this position the tilt slips are at the upper ends of their stroke, the upward movement being arrested by the engagement of the upper ends of the tilt slips with the shoulders, 8, on the body, 1; and the tilt slips being held in this position by the spring, 10, pressing upwardly on the rod, 11, and acting through the key, 17, engaging in key-seats, 16, in the tilt slips to hold the tilt slips upwardly to this position. The bearing portions, or "inward projections," 18, on the cutters which face inwardly or toward the axis of the tool bear against the flat parallel bearing faces on the downward extension and hold the lower ends of the tilt slips outwardly. In this position the dovetails on the slipways engage with the dovetails on the tilt slips so as to limit the outward movement of the tilt slips, and

(Testimony of Arthur P. Knight.)

each tilt slip is therefore firmly held against vertical upward strain which is taken by the shoulder, 18, against inward strain which is taken by the parallel bearing face of the downward extension, against outward strain which is taken by the dovetails, and against lateral strain which is taken by the faces of the slip ways. In this [566] position the cutting edges at the lower ends of the tilt slips are projected to a greater diameter than the body of the tool, and are adapted to ream a hole larger than the casing or the shoe at the lower end of the shoe, as illustrated in Figure 1. When the underreamer is to be withdrawn from the well the tool is pulled upwardly; the slips come in contact at their shouldered portions shown on their outer faces with the bottom of the shoe so that further upward movement of the tilt slips is temporarily arrested, and as the tool continues to be drawn upwardly the parallel bearing faces on the downward extension of the body slide upwardly between the bearing faces, 18, on the tilt slips until the shoulders or spreading-bearings, 25, on the downward extension reach the upper faces or shoulders of the bearings or projections, 18, on the tilt slips; whereupon the inward pressure on the tilt slips due to the engagement of the shoe therewith forces the tilt slips inwardly; the said faces, 26, riding in on the spreading-bearings, 25, until the parts assume the collapsed position shown in Figure 3. In this collapsing action the tilt slips bear, or have a fulcrum, at or near their upper ends on the flat parallel bearing faces; and the pressure of the shoe

(Testimony of Arthur P. Knight.)

is exerted inwardly on the outer faces of the tilt slips somewhat below this fulcrum, but at a considerable distance above the lower or cutting ends of the tilt slips, so that even a limited movement of the portion of the tilt slip which engages the shoe will produce a comparatively large throw of the cutting edges. Moreover, in this collapsing action the tilt slips remain engaged laterally with the slip ways; said slip ways serving as means for holding the tilt slips against lateral movement in collapsing and expanding actions as well as in working position. In order to provide for the lateral support given by these slip ways at each side of the tilt slips, while enabling the outside bearing on the tilt slips by the shoe to be raised as high as possible, so as to give a great inward throw in [567] collapsing, the downward extension is slotted or cut away to allow the outer faces of the tilt slips to project out through the slots between the slip ways so as to be adapted to engage the shoe at a point above the lower ends of the slipways. The bearing of the shoe against the outside of the tilt slips is at a point above the bearing of the bearing face, 18, on the tilt slips with the flat parallel bearing faces on the downward extension of the body so that in the collapsing action by engagement with the shoe, the upper as well as the lower portions of the tilt slips are held inwardly by such pressure of the shoe, and as the tilt slips slide downward relatively to the downward extension and slipways thereon, the dovetails or flanges, 29, on the tilt slips immediately leave the dovetails or flanges on the

(Testimony of Arthur P. Knight.)

slipways. When the underreamer with the tilt slips collapsed as shown in Figure 3 is moved downwardly in the casing so as to pass beneath the shoe, the above described operation is reversed; the spring, 10, which has been compressed in the collapsing operation, tending to draw the tilt slips upwardly and causing the upper faces, 26, on their bearing portions or projections, 18, to ride or slide outwardly on the spreading-bearings, 25, causing the cutting portions of the lower ends of the tilt slips to be expanded outwardly, until said bearing portions or projections, 18, ride onto the flat parallel bearing faces of the downward extension; whereupon the tilt slips move directly upward until their upper ends strike the thrust-bearings or shoulders, 8, and dovetails or flanges, 29, come into contact with the dovetails on the slipways. These dovetails, therefore, do not come into action in the normal and expanding and collapsing operation except when the tilt slips are fully expanded in the position shown in Figure 1. If, however, for any reason, an inward pressure is exerted on the lower ends or cutting edges of the tilt slips, and at the same time the body of the tool is drawn upwardly with respect to the tilt slips, so as to cause the tilt [568] slips to slip downwardly, relative to the downward extension of the body, these dovetails come into operation by reason of a taper or inclination thereof which permits the upper ends of the dovetails or flanges on the tilt slips to swing outwardly to a limited extent, as they slip downwardly into wider portions of the slip ways between the

(Testimony of Arthur P. Knight.)

tapered dovetails. This action, however, cannot occur unless there is an inward pressure on the lower ends of the cutters. This action takes place while the bearing faces or projections, 18, of the tilt slips are in engagement with the flat parallel bearing-faces of the downward extension, and permits the lower ends or cutting portions of the tilt slips to move slightly inward with inward pressure thereon by outward displacement of their upper ends. This action, however, can only take place in case there is an inward pressure on the lower ends of the tilt slips below the bearings of the tilt slips by projections, 18, thereof on the flat parallel bearing faces, and cannot occur in normal collapsing operation by engagement of the shoe, as it is essential to the principle of operation of this patent that the bearing on the shoe should be at a considerable distance above the cutting edges so as to provide for sufficient inward throw in collapsing to effectively clear the cutting edges from the casing. The essential features of the Double underreamer are a hollow body containing the spring and rod for pulling the tilt slips upwardly in normal working position, said rod being provided with a key, and said hollow body being provided with a downward extension in which the tilt slips are slidably and tiltingly mounted, the tilt slips hung on said key on the rod, and the shoulders or bearing faces on the tilt slips and downward extension of the body which cause the lower ends or cutting edges of the tilt slips to be spread outwardly as the tilt slips are moved upwardly by the spring-

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actuated rod. A further feature of the reamer shown in this patent is the provision for a thrust-bearing at the upper ends of the tilt slips, an inside bearing [569] at the lower portion of the tilt slips for resisting inward movement of the cutters, side bearings (slip ways) for resisting lateral movement, and outside bearings (dovetails) for resisting outward movement of the cutters, these lower inside bearings being above the spreading-bearings aforesaid on the downward extension, so that in the upward movement of the tilt slips to expanded position they ride onto these inside thrust-bearings after they pass or leave the spreading-bearing. A further feature of the underreamer shown in this patent is the provision for the projection of portions of the tilt slips through slots or spaces between the slip ways on the downward extension of the body, so as to enable the shoe to bear on the tilt slips at a point sufficiently near the fulcrum of said tilt slips at or near their upper ends to give a magnified or enlarged inward throw to the lower cutting edges of the tilt slips, while presenting the lateral and outside thrust-bearings for the tilt slips due to the extension of the downward extension of the body alongside of the tilt slips when in working position. A further feature of the underreamer shown in this patent is the inclination or taper of the dovetails on the tilt slips and downward extension of the body, permitting collapsing movement when, for any reason, an inward pressure is brought upon the lower ends or cutting edges of the tilt slips concurrently with an

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upward pull on the tool.

Another feature of the underreamer shown in this patent is the special means provided for facilitating assemblage of the parts by making the key on the spring-actuated rod removable and notching the said key so as to engage with the spring-actuated rod so as to hold the key in position in normal operation.

“Complainants’ Exhibit Wilson Reamer” comprises a hollow body having a downward extension provided with slip ways in which tilt slips are mounted to slip vertically and to tilt so as to collapse or expand at their lower ends; said downward extension and [570] said tilt slips being provided with interengaging portions for causing the lower ends of the tilt slips to spread out as the tilt slips slide upwardly. Said tilt slips are drawn upwardly in slip ways by a spring-actuated rod extending within the hollow body, and provided with a cross piece at its lower end serving as a key and engaging in key seats or recesses in the inner faces of the tilt slips, so that the tilt slips are hung or suspended on said spring-actuated rod. In this underreamer the spring which actuates the rod rests on a block which is held in fixed position in the hollow body by screw threaded pins screwed into the sides of the hollow body and projecting into said block. At the upper end of the slip ways the body is formed with thrust-shoulders against which the upper ends of the tilt slips engage when in working position. The lower portion of the said block in the hollow body serves as an inside bearing for the upper end portions of

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the tilt slips when in working position. At the lower end of the downward extension are provided the inclined spreading-bearings which engage the shoulders on the tilt slips to expand the tilt slips; and above these spreading-bearings the downward extension is provided with bearing faces which are slightly inclined or downwardly tapered and which engage bearing faces on the tilt slips to form inside thrust-bearings for the tilt slips. The slip ways in this underreamer are formed with dovetails or flanges engaging dovetails or flanges on the tilt slips to form outside bearings for the tilt slips when in expanded working position. The shanks of the tilt slips extend through a slot or space between the dovetails or side walls of the tilt slips so as to be exposed for contact with and operation by the shoe at the bottom of the casing at a point which is above the lower end of the downward extension and of the slip ways.

In this underreamer, therefore, as well as in the underreamer disclosed in patent 734,833, I find an underreamer body [571] which is made hollow to receive a spring-actuated rod, and which is provided at its lower end with a downward extension in which the slip ways are mounted to slip vertically and to tilt inwardly and outwardly, and said tilt slips being hung or suspended on said spring-actuated rod to be drawn upwardly thereby, and said downward extension being provided with spreading-bearings engaging with portions of the tilt slips to expand the tilt slips as they are drawn upwardly.

I also find in this underreamer, as well as the

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underreamer disclosed in Patent 734,833, slip ways, in which the tilt slips move and are retained against lateral displacement; thrust-bearings at the upper ends of said slip ways against which the upper ends of the tilt slips engage when in working position; inside thrust-bearings constituted by the slightly inclined or tapering faces directly above the spreading-bearings in this underreamer, "Complainants' Exhibit Wilson Reamer," and constituted by the lower portions of the flat parallel bearing faces on the downward extension in the said patent; and outside bearing faces constituted by the dovetails in the slip ways and on the tilt slips; and an upward inside bearing face constituted by the lower portions of the block within the hollow body in "Complainants' Exhibit Wilson Reamer," and constituted by the upper portions of the flat parallel faces on the downward extension in the patent.

I also find in "Complainants' Exhibit Wilson Underreamer," as well as in the reamer shown in patent 734,833, a hollow body having a downward extension provided with slip ways slotted to permit portions of the tilt slips to project or extend from the slip ways outwardly between the dovetails or sides of the slip ways so as to contact with the shoe at the lower end of the casing and to provide for such contact at a point which is considerably above the lower ends of the slip ways and of the downward extension. I do not find in "Complainants' Exhibit Wilson Reamer" [572] parallel bearing faces on the downward extension and tapering dovetails in the slip ways, inasmuch as the inside thrust-bearings di-

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rectly above the spreading-bearings, on the prongs or parts of the downward extension in this underreamer, taper slightly downward; and the dovetails in the slip ways are parallel to the axis of the body. As regards their function as thrust-bearings the deviation from parallelism in these bearings on the downward extension is not sufficient to permit or cause any downward movement of the tilt slips due to inward pressure thereon, so that these faces are effective in holding the tilt slips outwardly in normal working position; and are, therefore, considered with regard to this function, substantially although not actually, parallel with the axis of the body, as their deviation from parallelism is not sufficient to affect their action as thrust-bearings in the normal working position of the parts. Considering their action as sliding faces, when the cutters are being drawn down in the slip ways, these bearing faces permit of a slight inward movement of the lower ends of the tilt slips as they descend. When this downward movement of the tilt slips is effected by pressure of the shoe thereon this slight inward movement of the tilt slips is without any substantial effect, as it is not until the shoulders on the tilt slips reach and pass onto the spreading-bearings that the inward movement becomes sufficient to enable the tool to be drawn up in the casing. If the relative downward movement of the tilt slips is due to pressure imposed on their lower ends, these spreading-bearings will co-operate with the parallel-faced dovetails in "Complainants' Exhibit Wilson Reamer" in

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such manner that the inner ends or cutting portions of the tilt slips are released from such pressure as they move downward. In the underreamer shown in patent 734,833, the downward movement of the tilt slips accompanied by pressure on their lower ends results in the lower cutting portions of the tilt slips being allowed to move inwardly as the tilt slips move down; this movement being permitted by the taper of the dovetails, so that as regards this [573] effect of releasing the cutting edges, when pinched together, the tapering bearing faces of the downward extension in corelation with the parallel dovetails in "Complainants' Exhibit Wilson Reamer" have substantially the same effect as the parallel bearing faces and the tapering dovetails in the underreamer shown in Double patent 734,833. I do not find in "Complainants' Exhibit Wilson Reamer" the removable key detachably seated on the spring-actuated rod and constituting one feature of the underreamer shown in Double Patent 734,833. In regard to its function of serving as a means of hanging or suspending the tilt slips on the spring-actuated rod, this function is identical and performed in the same manner by a cross-piece in "Complainants' Exhibit Wilson Reamer" as it is by the key in the Double patent 734,833. In regard to the function of removability of the key in facilitating the assemblage of the parts, this special function I do not find in "Complainants' Exhibit Wilson Reamer." Instead of making the key removable, so as to enable the tilt slips to be hung onto the spring-actuated rod after

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the rod is inserted in the hollow body, the Wilson structure provides tilt slip suspending means which is integral with the spring-actuated rod and provides removable means for supporting the spring-actuated rod in the hollow body, so that the tilt slips may be assembled on the spring-actuated rod, the latter then shoved up into the hollow body and held in place by the releasable or detachable supporting means consisting of screw pins engaging in the block in the hollow body.

In "Complainants' Exhibit Wilson Underreamer No. 2," I find substantially the same construction and correlation of parts as in "Complainants' Exhibit Wilson Reamer" except in respect of the means for supporting the spring-actuated rod in the hollow body and for furnishing the upper inside bearing for the tilt slips. In this Wilson underreamer No. 2 the spring-actuated rod is provided with a key-way through which extends a key seated in the [574] walls of the hollow body, said key engaging the lower ends of the spring to support the same and thereby hold the spring-actuated rod in position. The lower portion of this spring-actuated rod in this Wilson underreamer No. 2 is provided with flat faces directly above the cross-piece or key portions thereon to serve as inside upper bearing faces for the tilt slips. A key engaging the spring as above stated performs the same function as the block within the hollow body in "Complainants' Exhibit Wilson Reamer" and as the shoulder within the hollow body of the Double patent 734,833. The flat bearing por-

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tions on the lower portion of the spring-actuated rod, in "Complainants' Exhibit Wilson Underreamer No. 2," directly above the key projections thereon, serve the same purpose as the lower portions of the block within the hollow body of "Complainants' Exhibit Wilson Reamer," and the same purpose as the upper portions of the flat parallel bearing faces on the downward extension in Double patent 734,833.

I, therefore, find, in underreamer shown in Double patent 734,833, in "Complainants' Exhibit Wilson Reamer," and in "Complainants' Exhibit Wilson Underreamer No. 2," and in each and every one of them: A hollow body; a spring-actuated rod mounted within the hollow body, and said spring being supported by the hollow body so as to tend to draw said rod upwardly; tilt slips mounted to slip vertically and to tilt inwardly and outwardly in a downward extension of said hollow body and hung on said rod so as to be drawn upwardly by said spring; and spreading-bearings on said downward extension engaging with parts on the tilt slip to expand the tilt slips and spread their lower cutting edges apart as the tilt slips are forced upwardly into working position by said spring. The stated parts co-operate to expand the tilt slips to cutting or working position when it passes below the shoe and to collapse the cutters to enable them to pass within the casing as it passes up within the shoe in the same manner and by the same mode of operation in the said patent, in "Complainants' Exhibit Wilson Reamer" and [575] in "Complainants' Exhibit Wilson Underreamer No. 2." I also find in the underreamer

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shown in Double patent 734,833, in "Complainants' Exhibit Wilson Reamer," and in "Complainants' Exhibit Wilson Underreamer No. 2," the tilt slips vertically and tiltingly movably in slip ways on the downward extension of the body; the said slip ways being provided with dovetails which co-operate with dovetails on the tilt slips to furnish outside bearings for the tilt slips; said tilt slips engaging at their upper ends with thrust-bearings on the body and having inside upper bearings in fixed relation to the body as regards inward movement, and having lower inside bearings which take the inthrust due to inward pressure on the cutting edges; said inside lower bearings being directly above the spreading-bearings on the downward extension of the body, so that in each case the tilt slips are firmly held when in working position against upthrust, lateral thrust, inthrust, and outthrust; and in this respect the stated parts of the said patent and of "Complainants' Exhibit Wilson Reamer" and "Complainants' Exhibit Wilson Underreamer No. 2," operate by the same mode of operation.

I also find in each of these exhibits, Double Patent No. 734,833, "Complainants' Exhibit Wilson Reamer," and "Complainants' Exhibit Wilson Underreamer No. 2," the downward extension slotted to permit portions of the tilt slips to extend outwardly from the slip ways through the sides of the tool to engage with the casing and with the shoe at a point considerably above the lower ends of the slip ways and of the downward extension so as to provide

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for a considerable inward and outward throw of the cutting edges of the tilt slips, so as to remove the cutting edges from the casing when they are collapsed, sufficiently to insure that the cutting portions will be free from any obstructions in the casing when the tool is being lowered in the casing. In this respect the parts of the underreamer shown in the Double patent 734,833, and "Complainants' Exhibit Wilson Reamer" and "Complainants' Exhibit Wilson Underreamer [576] No. 2," have the same relation of parts and the same mode of operation.

In respect to the taper of the dovetails and the flat parallel bearing faces in Double patent 734,833, I find that the straight or parallel dovetails and the slightly inclined inner thrust-bearings on the lower portions of the downward extension or prongs, of "Complainants' Exhibit Wilson Reamer" and "Complainants' Exhibit Wilson Underreamer No. 2," have an equivalent relation and equivalent mode of operation to that of the stated parts in the said Double patent. I find that instead of the removable key shown in the Double patent and the integral shoulder on the hollow body shown in said patent, that there have been substituted in "Complainants' Exhibit Wilson Reamer" and "Complainants' Exhibit Wilson Underreamer No. 2," an integral key or tilt slip engaging means on the spring-actuated rod, and a releasable means on the hollow body for supporting the spring; while the purpose and result of these are the same in either case, namely, to facilitate or enable the insertion and withdrawal of the

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parts, the mode of operation in this respect is not the same.

Recalled.

Direct Examination Resumed.

A. 15. "Defendant's Exhibit Wilson Patent 827,-595" shows and describes an underreamer which is substantially the same as "Complainants' Exhibit Wilson Reamer," the only difference being in minor details of construction as follows: The bearing block forming a seat or shoulder for the actuated spring to rest on is shown at 7 in the said patent in the form of a round block, and is held in place by means of two dowel-pins, 8; whereas, the corresponding block in "Complainants' Exhibit Wilson Reamer" is squared at its lower end and is held in place by screw pins.

The squaring of the lower end of this block gives a better inside upper bearing for the tilt slips, but the principle of action and the mode of operation are the same in the patent and in "Complainants' [577] Exhibit Wilson Reamer" irrespective of this change in the block. The only other difference I find is a slight difference in the shape of some of the bearing faces and shoulders on the tilt slips. The rounding shown at shoulder 16 in Figures 8 and 9 in said patent not being noticeable in "Complainants' Exhibit Wilson Reamer," which has, however, a perceptible rounding of the inwardly and upwardly directed corner or shoulder which is adapted to slide on the spreading-bearings, this rounding corresponding in function to the rounding of bearing 16 as set forth

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in the first six lines of page 2 of the Wilson patent. The principles of action and mode of operation of these parts, as well as all the other parts of the underreamer, are the same in "Complainants' Exhibit Wilson Reamer" and in "Defendant's Exhibit Wilson Patent."

A. 16. The construction of "Complainants' Exhibit Wilson Reamer" being substantially the same as that shown in "Defendant's Exhibit Wilson Patent," I will identify the parts of the Wilson reamer by reference to the drawings and specifications of said patent. In the Double patent the thrust-bearings on the body are indicated at 8 in the drawings, and are referred to as shoulders in the specification. In the Wilson patent these thrust-bearings are indicated at 10 in the drawings, and are referred to as "Down thrust bearings" 10 in the specification. The downward extension in the Double patent includes all those parts in integral and fixed relation with the body and extending beneath the shoulders or bearings, 8; this extension being differentiated from the body proper by reason of its being cut away or slotted to receive the tilt slips and the means for supporting and operating the same; in other words, it includes all those parts which extend downwardly from and are in fixed relation with the body, 1, of the underreamer. It, therefore, includes in the Double patent the portions forming the "upwardly and inwardly sloping tapering dovetail slip ways, 9 beneath said shoulders" in said patent, as well as the portion [578] which extends across between said dovetail portions and to which the numeral 6 is ap-

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plied in the drawing. This transversely extending portion of the downward extension is hollowed out or bored vertically to receive the lower portion of the spring-actuated rod and is slotted or provided with a key-way indicated at 7, in which travels the key, 17, for engaging the tilt slips. The entire downward extension of the Double reamer as shown in this patent, constitutes a hollow slotted extension, not only for the reason that it includes the transverse portion just referred to, which is hollow and slotted as stated, but for the reason that it also includes the portions forming the slip ways, 9, and is cut out or slotted between such portions forming the slip ways, forming slots extending outwardly from or between the slip ways so as to allow the tilt slips or portions thereof to project out through the sides of the said extension. In "Defendant's Exhibit Wilson Patent" the downward extension comprises all that part which is in fixed relation with the body of the reamer and extends below the thrust-bearing, 10. In this reamer the downward extension takes the form of two prongs, 2, forming a fork connected near their lower ends by a detachable cross-piece, 11, in the form of a bolt secured by a nut, 12. The transverse portion connecting the slip way portions of this extension in the Double patent is omitted or removed in the Wilson patent except in so far as the cross-piece, 11, may be considered as forming a transverse portion. But this downward extension in the Wilson patent being hollowed out or provided with a transverse slot extending from side to side between the slip way portions, constitutes a hollow slotted ex-

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tension. The prongs, 2, in the Wilson patent have shoulders, 2" on the inner faces to form ways, 3, for tilt slips, said ways, 3, having the same function in relation to the tilt slips as the slip ways in the Double patent, and these shoulders corresponding to the dovetail flanges, 29, of the slip ways, 9, in the Double patent. [579] Between these shoulders, 2" in the Wilson patent there is an opening or slot extending vertically between the slip way portions or prongs for permitting portions of the tilt slips to project out through the sides of the extension, these openings or slots corresponding in function to the openings or slots between the slip ways, 9, in the Double patent. The principle of action of the down thrust bearings, 10, in the Wilson patent is the same as the principle of action of the shoulders, 8, in the Double patent, serving in either case to furnish the downward pressure on the upper ends of the tilt slips or cutters in the working operation, so that the downward pressure due to the weight of the body and the parts connected to it is brought to bear on the tilt slips or cutters, forcing the latter to descend and to cut the rock by engagement therewith of their lower cutting edges. The principle of action and the function of the downward extension is the same in "Defendant's Exhibit Wilson Patent" as in "Complainants' Double Patent." In either case the object of this downward extension is to extend along the side of the cutters or tilt slips so as to support the same from lateral displacement and to furnish the requisite bearings for holding the cutters in rigid relation

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when in working position, while at the same time providing, by the hollowing out or slotting of this extension, for the reception of the tilt slips or cutters and of the means for operating the same, comprising the adjacent portion of the spring-actuated rod and the key or cross-piece thereon.

The spreading-bearings in the Double patent are indicated at 25 at the lower end of the transversely extending portion of the downward extension of the body, and is referred to in the specification as the rounded face 25 of the lower end of the downward extension, 6, of the mandrel. The spreading-bearings in the Wilson patent are shown at 17, and are referred to in the specification as "beveled end faces 17 of the downwardly projecting lugs 2'." In both the Double and Wilson patent these spreading-bearings are [580] inclined upwardly and outwardly from the center, so that when the shoulders on the tilt slips or cutters drag over these bearings the cutters will be tilted outwardly. The function and principle of action of these spreading-bearings with relation to the tilt slips or cutters are the same in the Wilson reamer, as shown in "Defendant's Exhibit Wilson Patent," and in the reamer shown in "Complainants' Exhibit Double Patent 734,833." In the Double patent these spreading-bearings are on the transversely extending portion which extends between the portions carrying the slip ways; whereas, in the Wilson patent these spreading-bearings are on the portions which carry the slip ways. One consequence of this difference in construction is that the spreading-bear-

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ings of the Wilson underreamer, as shown in "Defendant's Exhibit Wilson Patent," are separated by an intervening open space in which there is no bearing action, forming a separate spreading-bearing on each side; whereas, in the Double underreamer, as shown in "Complainant's Exhibit Double Patent," the spreading-bearing is a single continuous surface. The division or separation of the spreading-bearing in the Wilson reamer, however, does not change its principle of action, as the two separated parts are alike in form, and operate simultaneously on corresponding parts of the tilt slips, so that their action is concurrent and similar, and is equivalent in its mechanical spreading effect to a single spreading surface of equivalent bearing area. Another consequence of this separation of the spreading-bearings and the formation of the parts carrying the slip ways instead of on the part extending transversely between the slip ways, is that the spreading-bearings for the tilt slips are removed further from the axis of the tool in the Wilson reamer than is the case in the Double reamer. This outward displacement of the bearing surfaces, however, does not affect their function as spreading-bearings; so that the principle of action and mode of operation of these spreading-bearings in the Wilson underreamer [581] are the same as in the case of the underreamer shown in "Complainants' Exhibit Double Patent," this function being to expand and tilt out the underreamers so as to cause their lower ends provided with cutting edges to project out considerably beyond the body of

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the tool into position to perform their function of cutting a hole larger than the body of the tool. In order to hold the tilt slips or cutters in this expanded position, after they have been expanded, the inside thrust-bearings are provided as shown at each side of the transverse portion of the downward extension of the body in the Double patent, and referred to in the specification as "oppositely arranged parallel bearing faces," these thrust bearings being the lower portions of such faces adapted to co-act with the projections of bearing portions, 18, on the tilt slips. The lower inside thrust-bearings in the Wilson patent are shown at 9, and are referred to in the specification as spreading-bearings for holding the cutters 4, apart. These bearings, 9, are formed on lugs 2' at the lower ends of the prongs, and are slightly inclined inwardly and in a downward direction, but are so nearly parallel to the vertical axis of the tool that any inward pressure brought on the cutters is resisted by these bearings, and the cutters are thereby held out against the pressure or strain due to their impact on the rock; the function of these bearings being, in other words, as stated in the patent, to hold the cutters apart, which is the same function as performed by the flat parallel bearing faces on the transverse portion of the downward extension in the Double reamer. By reason of the omission of the transverse portion and the displacement of these thrust-bearing faces outwardly onto the portions carrying the slip ways, these bearing faces in the Wilson reamer are

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further apart than they are in the Double reamer and are separated so as to form two faces on each side instead of a single face on each side; but this change in construction or design in no way affects or changes their function [582] as inside thrust-bearings. The principle of action of these bearing faces, 9, regarded as thrust-bearings is the same in the Wilson reamer as the principle of action of the flat parallel bearing faces in the Double patent, co-operating with the inward projections, 18, of the tilt slips.

The upper inside bearings are indicated in the drawing of the Double patent as the upper portions of the at parallel bearing faces on the transverse portion of the downward extension of the body, namely, that portion of the parallel bearing faces against which the inner upper portions of the tilt slips engage when in working position as shown in Figure 1. In the Wilson patent the inside upper bearing faces are the lower faces of the block, 7, which is in rigid relation with the body when the tool is assembled, these faces engaging the upper inside portions of the cutters so as to take the inthrust at such portions. When the parts are in working position, shown in Figure 3, in the Wilson patent, and in Figure 1 of the Double patent, these inside bearings have the same principle of action and the same mode of operation in both the Wilson and Double reamers.

The tilt slips are indicated at 15 in the drawing of the Double patent, and are adapted to bear at their upper ends on their inside bearings aforesaid, and are provided with cutting edges at their lower outside

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portions and with inwardly projections or bearings, 18, which are adapted to ride on said parallel bearing faces, and with shoulders or faces, 26, above said bearings or projections, 18, which are adapted to slide on the spreading-bearings, 25, to cause the tilt slip to tilt so as to cause its lower end to move inwardly or outwardly while its upper end remains in contact with the upper inside bearing aforesaid; the principle of tilting being that one end (in this case the lower end) moves inwardly or outwardly while the other end (in this case the upper end) does not move inwardly or outwardly to any material extent. [583] In the Wilson reamer, as shown in "Defendant's Exhibit Wilson Patent," the tilt slips indicated at 4, and referred to in the specification as cutters, are provided with bearing faces 4³, bearing on the lower inside thrust-bearings, 9, in working position, shown in Figure 3; and with "rounded corners or bearings 16" at the upper end of these bearing faces 4³, to ride over the beveled end faces, 17, which constitute the spreading-bearings in this reamer, so as to cause expansion of permit collapse of the tilt slips. In "Defendant's Exhibit Wilson Patent" the cutters engage at their upper ends with the inside thrust-bearings constituted by the lower portions of block 7 in working position; but as the cutter or tilt slips move downwardly relative to the body, for example, in withdrawing the tool through the casing, as shown in Figure 1, these cutters or tilt-slips find a bearing on the outer ends of the cross-piece, 5, of the spring-actuated rod, which holds these upper ends from

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moving inwardly under the inward pressure of the shoe and causes a collapsing action to take place by tilting the lower ends of the cutters inward, this being a tilting action since the lower ends move in and out in operation, while the upper ends do not move in and out to any material extent. The tilt slips in both the Double underreamer, "Complainants' Exhibit Double Patent," and the Wilson underreamer, have recesses on their inner faces for receiving and engaging the key or cross-piece for hanging the tilt slips or cutters on the spring-actuated rod. In the Double patent these are referred to as sockets or key-seats, 16, and in the Wilson patent they are referred to as recesses, 18, in the inner faces of the cutters. In each case these recesses or sockets are shown as sufficiently larger than the key or cross-piece to enable tilting of the tilt slips or cutters. The principle of action and mode of operation of these tilt slips or cutters are the same in "Complainants' Exhibit Wilson Reamer," and in "Defendant's Exhibit Wilson Patent," and in the underreamer disclosed in "Complainants' Exhibit [584]. Double Patent 734,833." In the Double patent the bearings on these tilt slips for engaging with the spreading-bearings and with the lower inside thrust-bearings, are located directly on the inner faces of the tilt slips and extend across from side to side. In "Complainants' Exhibit Wilson Reamer" and in "Defendant's Exhibit Wilson Patent," the corresponding bearings on the tilt slips for engaging with the spreading bearings and with

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the lower inside thrust-bearings of the extension of the body, are located at each side of the center; this difference in construction or design following necessarily from the division of the said bearing faces on the extension of the body into separate parts at the respective sides, and in no way changing or affecting the principle of action or mode of operation of these bearings either in the spreading action or in holding the tilt slips or cutters apart after they had been spread.

The actuating means for lifting the tilt slips in the slip ways consist, in the reamer shown in "Complainants' Exhibit Double Patent," of the rod, 11, spring, 10, acting on said rod and resting on a shoulder, 5, in the body, and a key, 17, carried by said rod and extending into the sockets in the tilt slips so as to draw the same upwardly. The means for lifting the tilt slips in "Defendant's Exhibit Wilson Patent" consists in the rod or stem, 5', the spring, 6, acting on said rod or stem and resting on a bearing constituted by the block, 7, and a cross-piece or cross, 5, on the said rod extending into the recesses, 18, in the cutters or tilt slips so as to tend to lift the same. In each case the tilt slips are tiltingly hung or suspended on the spring-actuated rod by means of the cross-piece or key, as the case may be, and are drawn upwardly by the spring acting on said rod so as to tend to raise the tilt slips into working position and cause their bearing portions on said tilt slips to ride over the spreading-bearings on the extension of the

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body so as to tilt the tilt slips [585] and spread apart their lower ends while their upper ends are suspended on said spring-actuated rod. The principle of action of the means for lifting the tilt slips is the same in the Wilson reamer and in "Defendant's Exhibit Wilson Patent" as it is in the reamer disclosed in "Complainants' Exhibit Double Patent," consisting in hanging or suspending the tilt slips near their upper ends in such manner as to permit their lower ends to tilt or swing in and out and to exert a continual upward pressure on the tilt slips, tending to move them toward and hold them in working position.

Recalled.

Direct Examination Resumed.

A. 18. The Swan patent, 683,352, discloses an underreamer of type in which the cutters are mounted to slide obliquely on the reamer body without any tilting movement. The reamer body, A, in this patent is formed with ways, A⁷, extending obliquely inward and downward at each side, and the cutters or reaming heads, C, slide in these ways, the ways and reaming heads being dovetailed or flanged so as to retain and guide the reaming heads in their sliding movement in the ways. These reaming heads have slots which receive a cross-pin, B⁴, carried by a rod, B, mounted to slide vertically in the body of the reamer and pressed upwardly by a spring, B², which is supported by a bearing on the body, so as to tend to force the reaming heads upwardly. In this

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upward movement of the reaming heads they slide in the upwardly and outwardly diverging ways, A⁷, and are thereby caused to separate or expand as they move upwardly, and when they are at the upper ends of the ways they are fully expanded to working position. In order to enable the tool to be lowered through the casing, which is necessarily smaller than the fully expanded diameter of the cutting portions of the reaming heads, it is necessary to move the reaming heads to the lower ends of their inclined ways so as to bring them together before the underreamer can be inserted in the casing. If the underreamer with [586] the reaming heads collapsed in this manner is introduced into the casing, the spring-actuated rod will immediately tend to move the reaming heads upwardly and bring their cutting portions into contact with the casing. If, then, it be attempted to push the reaming tool down in the casing these cutting portions engaging with the casing will tend to move upwardly relatively to their inclined ways, and will thus be forced outwardly into tighter contact with the casing, so that the device in such circumstances would act as a casing spear, and could not, without some special means for preventing this action, be lowered into the well. For preventing this action and holding the reaming heads in collapsed position until the underreamer passes below the under end of the casing, there is provided, in this underreamer, a locking device consisting of trips, F, which are mounted to slide radially in the body of the reamer and are adapted to engage at their inner ends

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with the bevel face of the shoulder, B⁵, on the spring-actuated rod so that when the reaming heads are pulled down to collapsed position these trips may be pressed in to engage over said shoulder and then on inserting the tool into the casing the casing will engage with the trips to hold them into such engagement with the shoulder, thereby holding the reaming heads in collapsed position until the underreamer has been lowered far enough to bring the trips below the shoe at the bottom of the casing; whereupon the bevel face at the upper end of the shoulder on the rod forces the trips outwardly and allows the rod to rise, under the action of the spring, and to raise the reaming heads in their outwardly inclined ways, thereby expanding them to reaming position. In withdrawing the underreamer from the well the outer faces of the reaming heads unengage with the shoe at the bottom of the casing, and as the body of the tool continues to move upwardly, the heads slide in their inclined ways, so as to move inwardly until they have collapsed sufficiently to allow them to pass up within the casing. The [587] cutting portions of these reaming heads remaining in contact with the interior of the casing until the underreamer passes out at the top of the casing. Comparing this construction with "Complainants' Exhibit Double Patent" as to structure, the Swan structure comprises reaming heads which slide in inclined guideways so as to move to expanded or contracted position by oblique sliding movement without tilting; whereas, the Double con-

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struction comprises tilt slips which slip in slip ways in the body, and are moved to contracted or expanded position by a tilting operation, in which the lower ends, which form the cutting edges of the tilt slips swing inwardly or outwardly while their upper ends do not move inwardly or outwardly to any material extent. In other words, the Swan reamer is provided with means for engaging and supporting the reaming heads in such manner that each reaming head moves from its collapsed to its expanded position by a sliding movement in which all parts of the head partake in the same degree; whereas, the Double reamer provides means for expanding the lower portions of the tilt slips without correspondingly expanding the upper portions; this means consisting of spreading-bearings on the extension of the reamer body in the Double patent, and the shoulders or bearing faces on the tilt slips engaging such spreading-bearings for expanding the lower portions of the tilt slips, and the means for engaging the upper portions of the tilt slips to restrict or limit their inward and outward movements. In the Double patent the means for restricting the outward movement of the upper ends of the tilt slips as the lower ends are being expanded by reason of the shoulders on the tilt slips riding over the spreading-bearings, is a provision for allowing such upper portions of the tilt slips to engage with the shoe at the bottom of the casing, this action in normal operation taking place when the tilt slips are passing downwardly out of the shoe and

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their upper portions are bearing against such shoe, thereby holding such upper portions inwardly while the lower portions are being expanded by the action [588] of the spreading-bearings. The means for limiting the inward movement of the upper ends of the tilt slips in the Double patent, as the tilt slips are being drawn up within the shoe, consists in the upper portion of the flat parallel bearing faces of the transverse portion of the downward extension of the body, which engage with the upper inner faces of the tilt slips to hold them apart while the lower portions are being forced together by the pressure of the shoe, and are being allowed to come together by reason of their shoulders or inward projections riding inwardly over the spreading-bearings. This difference in the principle of coaction also leads to a difference in the mode of operation in so far as concerns the relations of the cutting edges of the tool to the parts liable to engage therewith. In the Swan reamer, inasmuch as the reaming head does not tilt, the cutting edge is necessarily always the most expanded portion of the reaming head, for the reason that in expanded position it must project further than any other portion in order to do its work; and in collapsing it does not change its position relatively to the other parts of the reaming head, so that it always remains the most expanded portion. In consequence of this, if any portion of the reaming head contacts with the casing it will be this cutting portion; and inasmuch as the cutting edges are outwardly and downwardly

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directed, such contact, as above pointed out, prevents the lowering of the reamer in the well, and it is therefore necessary to provide a locking device to hold the reaming heads temporarily in collapsed position until they are passed below the bottom of the casing. With the Double underreamer, which operates on the tilt slip principle, the cutting edges are not the most expanded portions except when the tilt slips are in expanded position. When the tilt slips are in collapsed position their most expanded portions are, as shown in Figure 3, of the Double patent, considerably above the cutting portions of the tilt slips and nearer the upper than [589] the lower ends of the tilt slips, so that by providing the slots in the sides of the extension of the reamer body, so as to enable these bearing portions of the tilt slips to come in contact with the shoe, and by providing the means above stated for limiting the inward movement of the upper ends of the tilt slips while allowing their lower ends to tilt in, the cutting edges of the tilt slips may be swung in so as to clear, by a considerable margin, the inside of the casing. With such construction, it is possible to insert the underreamer into a casing by first collapsing the tilt slips, so as to enable them to pass within the casing, and the cutting edges of the tilt slips will then be held free and clear of the casing by engagement with the casing and outer faces of the tilt slips which project through the slots in the side of the extension of the reamer body; and in this condition the reamer may be lowered in the well without

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any liability of the cutting edges catching on the joints or other obstructions in the casing and without the necessity of using any locking or tripping means for holding the tilt slips in collapsed position while they are passing down through the casing. Referring to "Defendant's Exhibit Double Underreamer with Narrow Cutters," this underreamer is substantially the same construction as disclosed in the Double patent, the following minor variations being noted: The spreading-bearings at the bottom of the downward extension of the body having been extended laterally so as to extend clear across the extension of the body; and the tilt slips are provided, in addition to the dovetails shown in the patent, with another set of dovetail flanges which extend out further in a lateral direction than do the main dovetail flanges and terminate at their upper ends on the shoulders which ride on the lateral extensions of the spreading-bearings; these flanges also proportionately widening the bearing portions on the tilt slips which engage with the flat parallel bearing faces on the extension to serve as inside lower thrust-bearings when in working position. These minor variations [590] make no difference in the principles of action or mode of operation of the parts. Referring to "Complainants' Exhibit Double Underreamer," the construction is similar to that shown in "Complainants' Exhibit Double Patent," except in changes in the proportions of the parts and for the following minor variations: The spreading-bearing at the lower end of the exten-

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sion is extended clear across, and adjacent thereto the lower ends of the portion of the extension forming the slip ways are cut out in the shape of V-shaped notches, the bits being provided with lateral projections having inside bearing faces adopted to rest on the inner faces of these notches when the tool is in working position; and having inclined outside faces which, in working position, are adjacent to the inclined outer faces of the notches. These minor differences in construction make no difference in the principle of action or mode of operation of the tilt slips in their collapsing and expanding actions and in their co-relation with the spreading-bearings and thrust-bearings on the body and the extension thereof. The principle of action of the Swan reamer, which is that of a sliding and nontilting reamer head, is, therefore, distinct and different from the principle of action disclosed in "Complainants' Exhibit Double Patent," "Defendant's Exhibit Double Underreamer" and "Complainants' Exhibit Double Underreamer," which is that of a tilt slip hung at its upper portion so as to move vertically without material inward or outward movement at its upper portion, and co-operating with bearings on the reamer body so that its lower portion is swung inwardly and outwardly so as to cause the cutting portions at the lower ends of the tilt slips to collapse and incline inwardly away from the casing or to expand and incline outwardly into position to engage the rock to be cut. [591]

The Day patent 403,877 shows a well-boring or drilling apparatus, comprising two cutting tools. B,

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carried by relatively thin spring plates, D, the upper ends of which are fastened together. The rod for operating the cutting tools fastens between the upper ends of the said parts and is connected to a block formed at its lower end with a spear point, I, a spring, K, being provided between this block and the upper portions of the supporting means, E, for the cutting tools and tending to press the cutting tools upwardly to bring shoulders, C, thereon against shoulders, H, on the block, G. The cutting tools, B, are provided with recesses, J, on their inner faces, which, in the most collapsed position of the device, receive and engage the spear point, I. When the device is lowered to the bottom of the well the cutting tools, B, and striking the bottom of the well are arrested and the spear point, I, being then forced down by the weight of the rod, F, and by the spring, K, causes the cutting tools, B, to be spread apart into position shown in figure 2 in which their cutting edges are expanded so that the drill is of greater diameter than the exterior of the casing. On withdrawing the tool by lifting the rod, F, the spear point, I, is drawn into the recesses J, and the spring-plates, D, cause the cutting tools to spring together in a collapsed position wherein they may be withdrawn through the casing. In this collapsed position the cutting portions are still the most expanded portions of the cutting tools so that if there is any contact with the casing it will be at these cutting portions. If, therefore, the pressure of the cutting tools on the casing is relied on in this device to

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maintain the cutters in collapsed position, such pressure will cause the cutting edges to engage with the casing and tend to force the cutting tools, B, upwardly relatively to the spear point, I, and to move toward the position shown in Figure 2. This operation would cause the cutters to catch or bind more and more tightly in the casing, [592] and in order to prevent this it would be necessary to make the spring plates, D, press inwardly with sufficient force to hold the parts in position shown in Figure 1 without depending on the inward pressure of the casing. This would require the spring plates, D, to be much more powerful in proportion to the spring, K, than is shown in the drawing. With such a construction in which the cutting tools, B, are held out of contact with the casing by the inward pressure of the spring plates, D, the principle of action and mode of operation of this device are quite distinct from that of the Double reamer as shown in "Complainants' Exhibit Double Patent," for the reason that in the Day device, as so constructed, the cutting tools must strike the bottom of the well and be arrested thereby before they can be separated by the action of the spear points; whereas, in the Double underreamer the tilt slips are expanded as soon as they pass below the shoe and do not have to reach the bottom of the well. If, on the other hand, the springs in the Day device are so proportioned that the inward pressure of the casing is relied on to hold the parts in position shown in Figure 1, the principle of action and mode of operation of this device are distinct

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and different from that of the Double underreamer in that, in the Day device, in this collapsed position, the cutting members engage with the casing at their cutting edges, and any obstruction or impediment to the downward movement will cause an increase in the pressure of such engagement by reason of the expanding action of the spear point; whereas, in the Double underreamer the engagement with the casing is at a portion of the cutting members which is sufficiently above the cutting edges to throw the cutting edges free and clear of the casing when in collapsed position; and any obstruction in the casing will simply throw the cutting edges further in if they are not already completely collapsed. A further important distinction between this Day underreamer and the Double underreamer, is the absence of the extension of the body of the [593] reamer which extends alongside of the cutting members (tilt slips), braces the same against the lateral displacement, furnishes the slip ways in which the tilt slips move, and supports the dovetail flanges which provide the outside bearings for the tilt slips when in working position. None of these features of the Double reamer, shown in "Complainants' Exhibit Double Patent" is disclosed in the Day patent. The Day patent, therefore, does not embody the principles of action and mode of operation which characterizes the Double reamer.

The Mack patent 492,371, relates to a casing spear, and has no reference to an underreamer such as shown in "Complainants' Exhibit Double Patent."

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This Mack patent shows slips which slide on dovetail inclined grooves so that as the slips move downwardly on the bottom of the tool they are expanded into position to grip the casing; this casing spear being adapted to engage the casing to draw the same upwardly. This patent illustrates the casing spear or gripping action which would occur if the locking device in the Swan patent were omitted. This patent, however, does not disclose any of the distinctive features of the principles of action or mode of operation of the Double patent, and in particular it does not disclose tilt slips near the body having an extension in which the tilt slips are mounted to move vertically and to tilt and provided with means for causing tilting movement of the tilt slips.

The North patent 674,793. This underreamer works on a rocking as distinguished from a tilting action of the cutting members. The two cutting jaws, d and d', are pivoted on a crosshead at the lower end of a spring-actuated bar movable in a hollow body and supported by a spring resting on a shoulder. The jaws are so supported that as their lower ends swing inwardly their upper ends above the pivots swing outwardly, and the movement of these upper ends is depended upon to control the position of the jaws, said upper ends engaging in an upwardly tapering socket, b, in the [594] body of the tool, so that as the spring-actuated rod draws the jaws upwardly the upper ends of the jaws are forced together by engagement with the tapering socket and the lower or cutting portions of the jaws

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are thereby forced apart or expanded to position shown in Figure 2. This patent shows a hollow body, a spring-actuated rod mounted therein and cutting members which are carried by said rod and are adapted to move vertically with the rod, and to be turned to different positions, but it does not show an extension of the body and provided with spreading-bearings engaging with the cutting members to tilt the same by spreading-action on the lower portions only of said cutting members. In the North patent the action is on the upper portion so that each jaw acts as a lever, the pressure holding it in position being applied at a separate end and the cutting force being applied at its lower end. In the Double under-reamer the pressure both for expanding the cutting members and for holding them apart after they have been expanded is applied at the lower portion of the cutters so that a direct support for the cutting pressure on the cutters is afforded as near as possible to the point of application of such pressure and without depending on the transmission of the force through a pivot. The North patent, therefore, lacks the distinctive principle of action of the Double under-reamer in that it does not have the spreading-bearings or the thrust-bearings for causing tilting action of the cutting members. It also lacks the slotted extension which permits the cutting members to project through the slots of the extension to engage the walls of the casing. In fact, North does not attempt to hold the cutting members in collapsed position for passing down through the casing by engage-

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ment of any portion of the cutting members with the casing, but depends on a locking device or latch shown at n, which holds the spring-actuated rod down until this latch passes below the shoe. If this latch were omitted and it were attempted to use the North [595] underreamer by depending on the pressure of the casing to hold the jaws in contracted position, there would be liability of the jaws catching or binding on the casing so as to prevent descent of the underreamer in the casing; and for this reason the latch or locking device is necessary to the mode of operation of the North device as disclosed in his patent. In respect to the mode of operation, therefore, this North device differs from the Double underreamer in that the North device requires a latch or lock for holding the cutting members in collapsed position while they are passing down through the casing; whereas, the Double underreamer, "Complainants' Exhibit Double Patent," requires no lock, but depends on the pressure of the casing on the tilt slips to hold the latter in collapsed position.

Kellerman patent 679,384. Two types of underreamer are shown in this patent. The type shown in Figures 1 to 12 requires some obstruction in the well either at the bottom of the well or else a block indicated by "X" placed across the well at the top of the portion which is to be reamed, such obstruction being necessary in order to engage the wedge, C, which is relied on to expand the cutting members, B', to cutting position. The mode of operation of this underreamer is, therefore, distinct from that of

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the Double underreamer, since the Double underreamer requires no obstruction for producing expanding action, such expanding action being effected as soon as the tilt slips pass below the shoe. This form shown in Figures 1 to 12 of the Kellerman patent also differs in construction and principle of action from the Double underreamer, inasmuch as the cutting members, B and B', are not tilt slips, since they tilt but do not slip on the supporting body; and there are no spreading-bearings on the supporting body, but wedge-bearings on a vertically movable actuating member. With such a construction the pressures or jars, due to the cutting action of the cutters, does not tend to hold the cutters into expanded position, but rather [596] to release by the jar-ring action the spreading wedge, C, so that with this construction it is necessary to provide locking means for holding the cutters in expanded position, and this locking means Kellerman provides at O. With such locking means Kellerman also provides special releasing means for unlocking the locking means and for driving out the wedge when it is desired to remove the underreamer up through the casing. This special releasing means consisting of a wedge, J, a carrier, K, therefor; a rope for supporting the carrier; and a weighted member, H. The object of all these parts being to provide means for disengaging the locking device and for holding the spreading wedge, C, in fixed position in the casing while the body of the tool is drawn upwardly so as to withdraw the cutting members, B and B', from the spreading

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wedge. The mode of operation of the Kellerman device both in bringing the cutting members into expanded position and in collapsing the same is, therefore, distinct from that of the Double underreamer, wherein the cutting members are expanded without the action of any obstruction in the well such as the block, "X," in the Kellerman patent, and are collapsed simply by passing up into the shoe without the action of the special releasing means H, J, K, L, M, provided by Kellerman for that purpose. In the forms shown in the figures 13 to 16 of the Kellerman Patent, the use of an obstructing block is dispensed with, a spring, S, being provided to force the spreading wedge, C⁴, up between the cutting members, B and B', as soon as the latter have passed beneath the lower end of the casing. If, when the cutting members have been expanded in this manner, it is attempted to raise the tool up through the casing, the expanded cutting members will engage the bottom of the casing; and as they cannot slip vertically on the body, A, but only tilt thereon, the resultant pressure on the cutting members simply causes them to be squeezed tightly onto the spreading wedge, C⁴, without collapsing, so that in order [597] to collapse the cutting members it is necessary to forcibly depress the spreading wedge, C⁴, by means apart from the cutters, and this is done by the operation of the special releasing devices, H, J, K, L, M, above referred to, which, when properly manipulated, serve to hold the spreading wedge down while the rest of the tool is drawn upwardly

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so as to allow the cutters to slide up on the spreading wedge and to collapse into position for withdrawal through the casing. Neither of the forms shown in the Kellerman patent, therefore, embody the principle of the tilt slips, of the spreading-bearing on the extensions of the body, of the slotted extension through the slots of which the tilt slips project to engage the casing for holding the cutting portions in collapsed position or the inside thrust-bearings which normally hold the tilt slips in expanded position but enables the tilt slips to slide down over the same and to then collapse by the riding of their shoulders on the spreading-bearings.

Patent to Mack 496,317. In this patent the reaming bits, F, are carried at the ends of long elastic legs, D, extending downwardly from a shank, C. The reaming bits are forced into expanded position by means of a so-called mandrel, J', whose lower end is beveled so that when it is forced downwardly it spreads the reaming bits apart, this mandrel being carried by one member of a toggle device, the other member of which is a telescoping and provided with a spring for forcing the knuckle J² of the toggle device and the mandrel, J, downwardly into expanded position. In passing down through the casing this expanding means is held inoperative by a latch, L, having a projecting end, L³, which projects through a slot in one of the spring legs, D, so as to engage with the casing and hold the toggle from straightening out. As soon as this latch passes below the bottom of the casing it allows the toggle to be

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straightened out by the action of the spring and mandrel J' to be shoved down beneath the reaming bits so as to spread the same apart. [598] Even when the reaming bits are in most collapsed position so as to pass down through the casing their most expanded parts are at the cutting edges as shown in Figure 1, so that if this underreamer shown in the Mack patent depended on pressure of the casing on the bits to hold them in collapsed position they would be liable to catch and bind on the casing for the reasons above stated in connection with the Day patent. This Mack patent, therefore, does not embody the same mode of operation or the same principle of action as the Double Underreamer, "Complainants' Exhibit Double Patent," for the reason it does not have the tilt slips or the spreading-bearings for expanding and collapsing the lower ends of the tilt slips by relative vertical movement of the spreading-bearings and tilt slips; nor does it have the extension of the body furnishing lateral support and slipways for the tilt slips; nor provided with slots through which the tilt slips extend to engage the casing at points considerably above the cutting edges so as to throw the cutting edges inwardly away from the casing while such bearing portions are in contact with the casing; nor does this patent show the slipways provided on the dovetails—all of which features are embodied in the Double underreamer, "Complainants' Exhibit Double Patent."

Palm patent 563,054. This is an apparatus for jarring casings and acts, in regard to gripping the

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casing, in the manner of an upwardly acting casing spear similar to the Mack patent 492,371 above discussed, and the same remarks as to comparison of this patent with the Double underreamer apply as in the case of the said Mack patent.

Mentry patent 647,605. This underreamer is of the sliding cutter type exemplified by the Swan patent, being provided with cutter-heads, K, which slide on downwardly and inwardly inclined dovetail grooves, and are pressed upwardly by a spring-actuated rod having a key engaging the cutters. Such a construction for [599] reasons above stated requires a locking means or retaining means to hold the cutters in collapsed position until they pass below the casing, since in the absence of any such locking means the cutters would engage with the walls of the casing in such manner that the tool could not be forced down through the casing. The locking or holding means provided by Mentry consists of a wire or cord, P, shown in the dotted lines in Figure 1, which is placed temporarily around the cutters to hold them in contracted position at the bottom of the inclined grooves. This wire or cord being "broken as soon as the bit strikes the bottom or when the cutter strikes any obstacle in the well"; the cutters then being moved to expanded position by the spring, E. This patent, therefore, does not disclose the tilt slips, the spreading-bearings for tilting the tilt slips in their vertical movement relatively to the spreading-bearings, the body formed with an extension carrying the spreading-bearings and slotted to per-

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mit of the tilt slips extending through the slots to engage the casing and hold the tilt slips in collapsed position without the use of any locking means.

Sullivan U. S. patent 79,276. This is an expanding reamer for machine-shop work such as are used in drills or lathes for reaming out holes in metal to a given diameter; has nothing to do with an underreaming tool of the Double type, in which the reaming is performed by longitudinal movement; nor does it provide for any collapsing or expanding action in the manner required in a well underreaming tool. The expanding and contracting action in this reamer is done by setting up the parts and not by automatic action due to the movement of the tool within a casing or shoe. This patent, therefore, does not embody any of the principles of action or the mode of operation of the Double underreamer.

Lloyd patent 344,744. This reaming tool comprises two jaws, A' and A², one of which is connected with the supporting shank, the other jaw, A², being pivoted to the jaw A', and a [600] spreading block, B, being drawn by a spring, C, so as to enter between the jaws and force the same into expanded position. For reasons stated in connection with the operation of the Kellerman patent, which is based on a similar principle, the pivoted jaws, A', A², cannot be collapsed by simply drawing them up into a shoe or casing without providing for releasing the spreading means, B, by some special device. The special means provided by Lloyd for this purpose consists of catches, G, connected with the spreading means, B,

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and adapted to engage the lower end of the casing or shoe so as to hold the spreading-means, B, down while the jaws A' A² are drawn up off of the spreading-means and thereby allowed to collapse into position for withdrawal through the casing. This patent, therefore, does not embody the distinctive principle of the tilt slips and spreading bearings of the Double underreamer which permits the cutting members to collapse automatically by engagement with the shoe and by a sliding movement of the tilt slips relatively to the spreading bearings; nor does this patent show the body with the extension furnishing lateral supports, slipways and dovetails for the tilt slips, with the principles of operation involved in these several features.

Hobart and Ahearn patent 439,275. This is a rock drill of the rotary type and is provided, in addition to the bottom cutters, with side cutters which are expansible or collapsible so as to provide at will for enlargement of the bore of the drill hole at any point of its length. These bits are mounted to slide on inclined ways, so that longitudinal movement of the bits spreads them apart, and such longitudinal movement is effected by hydraulic pressure furnished through a pipe which supports the drill; this pressure acting on the piston in the cylinder, which piston is connected to the said expansible cutters so as to move the same longitudinally on their inclined ways and expand or contract the same. The mode of operation of this device is distinct from that [601] of the Double underreamer inasmuch as the expan-

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sion and contraction is controlled at will through hydraulic means irrespective of the longitudinal movement of the drill or its relation to the casing; and the cutting operation is rotary instead of longitudinal. The principle of action of the Hobart and Ahearn drill is also distinct from that of the Double underreamer in "Complainants' Exhibit Double Patent" in that it does not embody the tilt slips, the spreading-bearings, and the other features above stated, which characterize the Double underreamer.

Deisch patent 526,440. In this patent the bits, C, are mounted in slots in a stock, A, so that their lower ends, acting as cutting edges, project out beyond the body of the stock when in expanded position. A spring-actuated rod carries a spreader-head, D, which engages these bits to move and hold them to expanded position. Locking means are provided for holding this acting rod and the spreader-head down while the reamer is being lowered through the casing, this means consisting of the locking-head, E, mounted on the rod and adapted to engage in a slot, 2, in the stock, and having a portion, e', projecting through the side of the stock to engage the well casing so as to hold the locking device in locking position until it passes the lower end of the casing, whereupon a spring, e³, throws a locking device into position shown in Figure 1, allowing the spreader-head, D, to be raised by spring, J, into position to expand the bits, C. This well reamer, therefore, depends on the use of a locking device for preventing expansion of the bits while they are being lowered

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in the well casing, and this is necessary with Deisch's construction for the reason there are no portions of his bits which in the collapsed position, or any other position, extend out further than the cutting edges so as to be adapted to engage with the casing, to hold the bits collapsed and throw the cutting edges clear of the casing. The principle of action of the Deisch reamer is also different from that of the Double [602] underreamer, "Complainants' Exhibit Double Patent," in that it does not embody the tilt slips and the spreading-bearings for spreading out the lower ends of said tilt slips on relative sliding movement of said tilt slips and spreading-bearings; said spreading-bearings being carried by the body and said tilt slips being movable vertically, so that this relative movement is produced automatically in drawing the bits up into the shoe or passing them down out of the shoe by reason of the engagement of the shoe with the bits.

Yorke patent, 475,913. This underreamer comprises cutters at the lower ends of the spring arms, carried by a shank in which is slidably mounted a spring-actuated bar, which is provided with a so-called wedge engaging with inclined bearings on the cutters to force the same apart. The most expanded portions of these cutters are their cutting portions, and, as in the case of the Mack and Deisch patents, means are provided for preventing expansion of the cutters until they have passed below the casing; this means consisting of toggles, *m*, whose outer ends engage with the casing to hold the toggles bent as

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shown in Figure 1; and these toggles straightening out under the action of the spring, g, as shown in Figure 2, when they pass below the casing, so as to allow the wedge, k, to force the cutters apart. In this expanded position the wedge, k, so-called, engages between the parallel faces, 1, on the cutters; and if it were not for the special releasing means consisting of the toggle, m, attempted withdrawal of the reamer into the casing would simply bind the parts together, the withdrawing operation depending on the folding up of the toggle, m, by engagement of the casing so as to withdraw the wedge, k, from the faces, 1, of the cutters before the cutters can be collapsed. This patent does not embody the distinctive features of the Double patent, nor the principles of action or mode of operation thereof, inasmuch as it does not disclose the tilt slips; [603] the body on which the tilt slips are mounted to slip and tilt; and the spreading-bearings on the body which engage the tilt slips in their slipping movement to spread their lower ends apart; and the slots in the body through which the tilt slips extend for engagement with the casing.

Allen patent, 294,302. In this patent two so-called supplemental drills, D, are mounted within a guard, B, within grooves in a supporting stem, and are spread apart by bearing faces on the drills riding over part b of the stem. No means are provided for actuating these drills, the mode of operation being that when the tool reaches the bottom of the hole the lower ends of these drills engage said bottom so

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as to be forced up relatively to the part by and to be spread apart thereby, and they are then retained in this position by engagement of catches, *e*, with notches, *c*, in the shanks of the drills. In order to enable the collapse of the drills as the tool is being withdrawn through the casing these catches are provided with portions which engage with the casing so as to release the same in this operation. These portions necessarily project beyond the sides of the tool so as to engage with the casing, and are, therefore, liable to be operated by contact with any obstruction at the side of the well, so that when the drills have been expanded by dropping the tool to the bottom of the well, and are then raised for the reaming operation, the engagement of the catches with the casing or with any projecting part in the well would release the drills and allow them to fall into collapsed position again. This mode of operation is distinct from that of the Double underreamer wherein the cutting members are formed as tilt slips operated by direct engagement of portions thereof with the casing or shoe and forced into operative position by a spring-actuated rod so that they do not depend upon being brought to contact with the bottom of the well in order to be expanded to working position, and do not depend upon any catch means [604] for holding them in expanded position.

Carruthers patent, 479,933. This patent relates to a casing spear, and the same remarks apply as in the casing spear patents heretofore considered.

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Duncan patent, 662,895. The cutters, C, in this patent are simply pivotally mounted on the body, and are held in expanded position by the simple action of a spring. There are no thrust-bearings in this patent which positively and rigidly hold the cutters into expanded position, the cutters being yieldingly held in expanded position; nor does this patent embody tilt slips of the Double underreamer provided with portions bearing on and widening over thrust-bearings and spreading-bearings as provided for in the Double underreamer.

O'Donnell & Willard patent, 762,435. In this patent the body of the underreamer is provided with a tapering bowl at its lower end, and with a downwardly tapering transverse partition extending across said bowl. The cutting members are formed as jaws having upwardly tapering shanks adapted to fit in the two parts of the bowl at opposite sides of said partition; said shanks being hung on a cross-head on a spring-actuated rod mounted in a hollow in the body. The transverse partition extends below the bottom of the bowl and the cutting jaws have shoulders which engage with the bottom of the bowl to limit the upward movement of the jaws. When this tool is withdrawn into the shoe, the shoe engages with the jaws below the bottom of the bowl; but above the bottom of the transverse partition; so that the pressure of the shoe on the jaws holds the jaws from upward movement; and the continued upward movement of the body withdraws the transverse partition from between the inclined inner faces

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of the shanks of the jaws. At this time the inward pressure of the shoe on the jaws keeps these inclined inner faces in tight contact with the inclined faces of the partition, 3, so that during the first part of the movement, [605] at least, the jaws simply slide inward and downward on the partition without any tilting action. As soon as the point of contact of the shoe with the jaw passes below the inclined bearing face at the side of the partition, 3, there is a tendency to rock the lower portion of the jaw inwardly and swing the upper portion of the jaw outwardly. This is, properly speaking, however, a rocking and not a tilting action, as the fulcrum of the motion is not at the upper end of the jaw shank, but at the lower end of the partition; and it is due, not to the riding of a shoulder or inwardly facing bearing of the jaw on a spreading-bearing of an extension of the body, but to rocking of a straight flat face of the shank teetering on the rounded lower end portion of the partition, 3. This is clearly shown in Figure 1, wherein, however, the rocking or teetering motion is emphasized; whereas, the characteristic motion of the jaws in this O'Donnell & Willard reamer is inward and downward sliding movement comparable to that of the Swan patent. This patent, therefore, does not disclose the characteristic features of the Double construction, consisting in a body having an extension, provided with spreading-bearings and tilt slips mounted to slip and tilt in said extension; and provided with shoulders or inwardly facing projections

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riding on such spreading-bearings to expand and collapse the lower portions of the tilt slips. This O'Donnell & Willard underreamer further does not disclose the slotted extension of the body and the tilt slips having portions projecting through the slots of the extension so as to engage the shoe or casing at points above the lower ends of the extension and considerably above the cutting edges at the lower ends of the tilt slips so as to provide for throwing the cutting edges inwardly free and clear of the casing by engagement with the shoe of portions considerably above said cutting edges. The portions of the O'Donnell & Willard jaws which engage with the casing or shoe are so near to the cutting edges (see [606] Figure 1) that the amount of inward throw or clearance of the cutting edges would be very small, and extreme nicety in dressing the tools would be necessary in order to prevent the cutting edges from catching on slight obstructions in the casing, if, indeed, it would be possible to prevent such catching. This O'Donnell & Willard patent furthermore does not embody the dovetail slip ways for furnishing outside bearings for the tilt slips when in working position while permitting projection of portions of the tilt slips to the outside of said slip ways and between the sides of the dovetail slip ways for engagement with the casing or shoe as stated. A spring-pressed bolt, 16, is provided in the O'Donnell & Willard underreamer to lock the cross-head on the spring-actuated rod from downward movement relative to the stock or body when the latter is drawn

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up, this bolt being released through the action of the pin, 21, engaging the shoe when the reamer is drawn up within the shoe at the bottom of the casing. This presents a different mode of operation than that of the Double patent, in which the spring-actuated rod and key or cross-head thereon are not restrained from downward movement except by the action of their supporting springs.

A. 20. This Plotts patent 668,340 shows an underreamer in which a cutter is pivotally mounted in a recess in the reamer body and is adapted to be collapsed in said recess or to swing out so as to project beyond the side of the body, this swinging-out action being effected by a spring-actuated rod mounted to slide vertically in the body and operated by a spring contained in a hollow in the body. The principle of action in this underreamer is that of a swinging cutter as distinguished from the tilt slip action of the Double underreamer, as shown in "Complainants' Exhibit Double Patent" and "Defendant's Exhibit Double Reamer," and in "Defendant's Exhibit Wilson Patent," and in "Complainants' Exhibit Wilson Reamer." This Plotts reamer differs in its mode of operation from the [607] Double reamer in that it is swung out by direct swing action and not by riding shoulders on the cutter over spreading-bearings in a vertical slipping movement of the cutter relatively to the body. In the Plotts reamer there is no relative slipping movement of the cutter relatively to the body, and no riding of any shoulders or projecting portions of the cutter over spreading-

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bearings, and no engagement of bearing portions on the cutter with thrust-bearings on the body or extension thereof for holding the cutter out to do its work. The principle of action, mode of operation, and correlation of the parts in the Plotts reamer, shown in patent 668,340, is different and distinct from the principle of action, mode of operation, and correlation of the parts in the Double reamer, "Complainants' Exhibit Double Patent," "Complainants' Exhibit Double Reamer," "Defendant's Exhibit Wilson Patent," "Complainants' Exhibit Wilson Underreamer No. 2," and "Complainants' Exhibit Wilson Reamer."

Q. 21. Are you familiar with "Defendant's Exhibit, page 82, Oil Well Supply Company's Catalog of 1900"? A. Yes, sir.

Q. 22. Will you please explain the mode of operation and interrelation of the parts of the underreamer or device illustrated in this exhibit, page 82, of Oil Well Supply Company's catalog of 1900, and with particular reference to the principles and mode of operation and co-action of the parts in expansion and contraction of the bits; and then compare the same with that of the said Plotts patent to which you have last referred; and also with the Double and Wilson underreamers?

A. So far as can be gathered from this exhibit, this Austrian underreamer comprises two cutters which are mounted to move pivotally in recesses in a body, and a spring-actuated rod is provided which appears to engage with the cutters so as to tend to

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force them to move to expanded position in which their outer portions [608] project beyond the sides of the body in the position for cutting, as shown in Figure 1717, which is upside down in the exhibit. The outer ends of these cutters are rounded, and, as shown in Figure 1715, engage with the casing to hold the cutters in collapsed position. The principle of action of this underreamer, so far as can be gathered from this exhibit, is that of a pivoted cutter operated by direct action of the spring, and is distinct and different from the principle of action of a tilt slip operated by riding over spreading-bearings and held out rigidly by engagement with thrust-bearings, as in the Double reamer, exemplified in the Double underreamer and Wilson underreamer, exemplified in the exhibits referred to. The principle of action in this Austrian underreamer, so far as it appears from this exhibit, is the same as that of "Defendant's Exhibit U. S. Plotts Patent 668,340." In both the Austrian and the Plotts reamers the upward strain on the cutters is exerted by leverage in a direction transverse to the length of the cutters when expanded, being taken by barings on the body and by the pivots of the cutters, and having a tendency to bend and break the cutters by transverse strain. In the Double and Wilson underreamers, on the other hand, the upward strain or pressure on the cutters due to the cutting action is imparted lengthwise of the cutters and is taken on fixed shoulders on the body, so that the bending or transverse strains are reduced to a

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minimum, practically the whole strain being a direct compression strain lengthwise of the cutters, and being taken directly by the shoulders on the body. In the Austrian and Plotts underreamers, the transverse pressure imparted to the cutters in this manner not only tends to bend and break the cutters, but exerts a shearing strain on the pivots or supporting pins for the cutters; whereas, in the tilt slip construction of the Double and Wilson underreamers there is no shearing strain on the suspending parts or cross pieces, the strain being taken entirely by fixed shoulders on the body and extension thereof. [609]

Q. 23. I now show you "Defendant's Exhibit Fig. 2161, Oil Well Supply Company's Catalog of 1900," and ask you to state if you are familiar therewith.

A. I am familiar therewith to the extent that I have given this exhibit considerable study.

Q. 24. From this exhibit can you point out for us the interrelation of the parts and the principle of co-action of the parts, and expansion and contraction, and mode of operation of the parts?

A. I cannot.

Q. 25. Why not?

A. It is not apparent to me, after careful study of this exhibit, that the same discloses any structure which would be operative according to any definite principle of operation. It does disclose a body with two outwardly and downwardly extending members which, presumably, are cutting bits, and a member extending between these bits. This intermediate

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member has inclined faces which appear to engage with shoulders on the bits, but there is nothing to show how these bits are supported, whether they are hung onto the body or onto the said intermediate member, nor does it appear whether this intermediate member is rigid on the body so as to form an extension thereof or is movable thereon, nor any means shown for operating the bits so as to move them to or hold them in the position shown in the figure. If I should attempt any explanation of the operation of this underreamer I should have to guess at the construction, and supply from imagination parts which are not shown in this figure. I am, therefore, unable, from an inspection of this figure, to arrive at any conclusion as to the principle of action or mode of operation of this reamer.

A. 29. In the O'Donnell & Willard patent a locking bolt, 16, is shown for locking the cross-head on the spring-actuated rod from downward movement in the body. In "Defendant's Exhibit O'Donnell & Willard Underreamer" this locking bolt is omitted, and there [610] are provided the parts referred to in said answer to question 351 of W. W. Wilson. This additional feature in the O'Donnell & Willard underreamer comprises a key passing through a slot in the body and extending over the top of the spring-actuated rod; the ring extending around the body and rigidly connected to this key and casing engaging means which are mounted to move in and out through the ring and slip in inclined slots on the body as they are moved vertically relatively to

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the body. When the reamer is drawn up into the shoe the shoe engages with these casing engaging means, holding the ring temporarily from upward movement; and, as the body of the tool continues to rise, the key, carried by said ring, engages with the top of the spring-actuated rod, to hold said rod down, while the body rises, thereby moving the cutter jaws positively downward relatively to the body and permitting them to swing in freely, the effect of this action being, as the witness stated, in answer to this question, to take the pressure of the spring off of the cutting jaws in the collapsing action; and this device being in function and effect a lock for preventing expanding action on the cutters as they are being passed into and through the casing.

Q. 30. Then the two differences in the elements, which you pointed out in your last answer, between the "Defendant's Exhibit O'Donnell & Willard Underreamer" and the disclosure and description of "Defendant's Exhibit O'Donnell & Willard Patent," make what difference in the subject matter?

A. The O'Donnell & Willard patent purports to disclose an underreamer which is capable of collapsing without the use of any locking means, whereas, the O'Donnell & Willard underreamer depends for its operation upon this locking means. The mode of operation of these two exhibits is, therefore, distinct and different inasmuch as one depends on a locking means for preventing expansion of the cutters while passing through the casing, while the other [611] does not depend on any such locking

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means; the locking means shown in the O'Donnell & Willard Patent" being to lock the cutters in expanded instead of in collapsed position.

Mr. BLAKESLEE.—We move to strike out all that part of the answer which refers to the dependence of this O'Donnell & Willard patent upon any locking means as being merely a guess and not a statement of opinion in expertation, and not the best evidence as to the operation of this reamer which has been testified to by other witnesses.

Q. 31. (By Mr. LYON.) In your explanation of the disclosure of "Complainants' Exhibit Double Patent," you refer to the bearing portions or "inward projections, 18, of the cutters which face inwardly or toward the axis of the tool." Is there any part in the bits or cutters of "Complainants' Exhibit Wilson Underreamer," or "Wilson Underreamer No. 2," for this purpose?

A. In both of these Wilson reamers the inwardly facing shoulders at each side of the lower portion of the cutters which terminate at their upper ends in abrupt shoulders, correspond in function to the inwardly projecting faces, 18, in "Complainants' Exhibit Double Patent." By way of identification I refer to "Defendant's Exhibit Wilson Patent" in which these inwardly facing bearings are indicated at 4³, and are referred to in the specification as expansion bearing faces of the cutters on the sides of said cutters.

Q. 32. Are these portions of the Wilson bits to which you have just referred projected along the

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inner or outer faces of the Wilson bits?

A. They are on the inner faces.

Q. 33. And how do their functions compare with the surface, 18, of the Double patent in suit to which you have referred? A. The function is the same.

Q. 34. And how does the shoulder formed at the upper end of these faces, 4³, compare with the function of the shoulders, 26, of the bits of the Double patent in suit? [612]

A. The function is the same.

Q. 35. You say that the function of these surfaces and shoulders is the same. What difference, if any, is there in the manner of performing such function?

A. The function is performed in the same manner in the normal working operation of the underreamer in each case.

I do not agree with Mr. W. W. Wilson that the expansion of the bits of the Double reamer is dependent upon the upward and inward inclination of the dovetails on the body, so far as the normal working operation is concerned.